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ANNUAL REPORT OF THE CHEMICAL DIVISION. FOR 1924.

By B. J. Eaton.

Staff.

The staff of the Division consisted of the following officers :—

Agricultural Chemist	...	B. J. Eaton.
Asst. Agrl. Chemists	...	R. O. Bishop, C. D. V. Georgi, V. R. Greenstreet, J. H. Dennett.
Asst. Analyst	...	Gunn Lay Teik.

The Agricultural Chemist was on service leave from the 26th April, till the end of the year, Mr. R. O. Bishop was on leave from the beginning of the year until 7th May. Major C. D. V. Georgi acted as Agricultural Chemist from the 27th April till the 8th May when, Mr. R. O. Bishop returned from leave and assumed duties as Acting Agricultural Chemist.

Mr. J. H. Dennett proceeded to Sandakan, British North Borneo on the 19th December in order to see and report on the production of power alcohol (alcohol-ether mixture) from the juice of the Nipah palm.

Organisation.

The Agricultural Chemist, in addition to administration duties, has been responsible for all reports and general supervision of all investigations carried out by the Assistant Agricultural Chemists. Special research investigations have been divided between the different officers as far as possible, so that one or more investigations are entirely undertaken by each individual officer. The special investigations completed or on hand during the year have been divided as follows:—

(1) Investigations on rubber and fibre.

(2) Investigations on guttapercha, nipah palm and the tapioca plant.

(3) Investigations on oils and fats and various indigenous forest products.

(4) Investigations on soils, fertilisers and jelutong.

In addition to the research work carried out during the year a number of miscellaneous routine analyses have been carried out, including some hundreds of samples of latex, which were examined on behalf of the United States Rubber Plantations and various estates from which this company was purchasing latex.

Details of the various researches and analyses undertaken are summarised briefly below in connection with the individual products under investigation.

Much time was devoted to the preparation and collection of samples and photographs of various agricultural products for the Agricultural Section of the Malaya Pavilion, British Empire Exhibition.

Rubber Research and Investigations.

Special researches on rubber problems have again been curtailed considerably on account of the amount of time which has had to be devoted to problems on other products and also investigations on dry rubber content and ammonia content of preserved latex which have been made in connection with the purchase of latex from various estates and its export from Malaya. Until the end of July the Chemical Division acted as referees or arbitrators. A large amount of valuable data has been collected in respect of the dry rubber content of latex from month to month and it is interesting to note that the average dry rubber content for the seven months' period is only a fraction above the standard for export of latex laid down by the Government during the year viz. 3·5 lbs. of dry rubber per gallon of latex. Interesting fluctuations in the concentration of the latex are also noted after resting periods and when new cuts are opened. The results confirm work previously published by other investigators. The figures also indicate that any mature estate can maintain this standard, provided the tapping and collection is controlled, so that the coolies do not add water to the latex in the field.

Latex samples to the number of 2864 were examined during the period of seven months to the end of July. These include the following determina- tions:—Total solids in 177 samples, dry rubber content in 2864 samples and ammonia content in 177 samples of latex and 18 samples of ammonia solution.

Since the "Dry rubber content" (i. e. commercial rubber) of latex is not a definite chemical entity and may vary according to the method of coagulation employed, experiments have been commenced to determine the variations, especially in the case of latex preserved with ammonia.

Further investigations on S. I. P. E. F. cured rubber were carried out, but could not be continued to completion, since the estates preparing this grade of rubber accepted contracts for the sale of the whole of their crop as latex.

This type of rubber, which resembles the "slab" rubber (matured coagulum), first prepared by this Department, but converted to dry crepe after maturation, was finding a ready sale at a slight premium among certain buyers in America. It is of interest to note that the cost of preparing the raw product is less than that of other first grade rubbers viz. smoked sheet and pale crepe, while the "lump" rubber from field coagulation can be added to the rubber and legitimately incorporated as first grade, since the appearance of the rubber is streaky and is no criterion of its intrinsic quality.

Investigations also showed the advantage of a moisture saturated atmosphere in the preparation of "slab" rubber.

Samples of crepe rubber, containing various dyes and pigments, used for the manufacture of coloured crepe mats, were vulcanised by the sulphur chloride cold-cure process for an estate and gave satisfactory results. The sulphur chloride was used in a carbon-tetrachloride solution, which appears to be a satisfactory substitute for carbon disulphide and not so dangerous or unpleasant.

Experiments on the cold storage of raw crepe mats and also similar mats containing loading material in the form of pigments etc. showed that these mats become very hard and stiff during cold weather and liable to crack at the joints of the various coloured pieces used in the design. This was also noted by the writer in the case of similar mats made in Malaya and Ceylon, which were being sold by a firm in the Malaya Pavilion at the British Empire Exhibition, Wembley.

This effect of climate may not be of much importance when these mats are used in warm houses, but is an important factor in the use of such mats in motor cars during cold weather.

Owing to the operation of the Rubber Restriction and Customs Enactment, it was found necessary to determine the rubber content of rubber articles manufactured in the Federated Malay States for export. As is well known the difficulties involved in such an estimation are considerable, owing to the variety and nature of the inorganic or organic compounds now used in different articles. Since it was found impossible to carry out these determinations in a reasonable period, on the recommendations of the Acting Agricultural Chemist it was decided to grade the various locally manufactured rubber articles, according to their average rubber contents. The Agricultural Chemist has acted as adviser to the Customs Department in connection with the definition of manufactured articles for export.

An investigation on the quality of rubber from latex after various resting periods was carried out and confirmed results obtained previously by other investigators. The results of this investigation will be published in the M.A.J. In connection with routine investigations on rubber samples, the principal enquiries have been concerned with defects in smoked sheet such as bubbles and "rust."

Latex paper:—Investigations on the quality of certain latex papers were commenced and completed. The results of the investigation, especially in connection with ageing of these papers do not

appear to indicate any advantage from their use, unless the paper can be purchased more cheaply than non-latex paper: A detailed report of this investigation is being prepared for publication in the M.A.J.

Rubber oil:—Considerable local interest has been taken in connection with the oil prepared by the dry or destructive distillation of lower grade rubbers, owing to the work which was commenced on an estate in Perak. The Chemical Division has indicated that there is nothing essentially new or novel in the process, since the investigation of the oil obtained by this method had been carried out many years ago by various chemists of repute in Great Britain and elsewhere. On this account an application for a patent for the process was refused in this country. At the same time there may be certain applications for such an oil or for certain fractions of such an oil, provided the cost of the raw material (lower grade rubber-scrap etc.) is nil or very low and the cost of distillation not high. The oil may be a useful product for internal combustion engines but it must be remembered that petrol, even in Malaya, where the price is high, costs about 4d. per lb. and one pound of rubber, even at maximum efficiency, can only produce 1 lb. of oil and is likely to produce less. The specific gravity of the oil is probably higher than that of petrol, so that assuming it to be 0.800, it will require at least 8 lbs. of rubber to produce a gallon of oil. Such an oil may have other uses as a solvent or for medicinal purposes, as a vehicle for paints, varnishes etc., but will have to compete with other cheap oils.

A large number of samples of latex, rubber in different stages of preparation, estate samples of block, slab, smoked sheet, pale crepe and sole crepe, rubber mats and other articles made from raw rubber were prepared and collected for the Malaya Pavilion, British Empire Exhibition. The tapping of a rubber tree, which was arranged by this Division, attracted considerable attention and interest in the Malaya Pavilion.

Guttapercha.

Investigations on the mechanical extraction of guttapercha from the leaf were continued and completed. A satisfactory method, which resembles that used in Java and also in Malaya was devised. A report on this work will be prepared for publication in the M.A.J. The investigation was of considerable interest as a problem in grinding material of this kind, since it was found that the method of grinding is of great importance as far as the yield of guttapercha is concerned. The samples of guttapercha were of good quality and contained a low percentage of dirt and fibre.

Jelutong.

Considerable interest has been taken in jelutong, for export to the U.S.A. where it is used, mixed with chicle gum, derived from South America, as the principal constituent of chewing gum.

Investigations on the methods of coagulation and preparation, the determination of the moisture content and the keeping qualities of samples prepared in different ways have been carried out

during the year and two reports published in the M.A.J. Samples of coagulants containing "preserving" agents have also been examined. Advice has also been given to manufacturers of jelutong and consultations have been arranged with buyers in Singapore.

Oils and Fats.

The following samples of various fats and oils and raw products yielding oils and fats have been investigated. Borneo tallow (illipe fat), ground nut oil, rubber seed oil, desiccated coconut, copra, coconut oil and copra cake. The quality of the locally manufactured coconut oils is high and the free fatty acid content is low.

Two samples of Nyireh fruit (*N. batu* and *N. bunga*) were examined for the Forestry Department and found to contain no oil.

Palm oil:—At the request of the Honourable The Chief Secretary, experiments were carried out to determine whether more palm oil could be extracted from the residual pericarp after this has been treated by the primitive methods at present in use in Malaya and Sumatra. This residue contains about 25 per cent. of oil and it was found that 5 per cent, based on the weight of the material, could be obtained by boiling the pericarp with water and subsequent pressing in a hand-screw press. Modern machinery for the extraction of the oil with a resulting higher yield of oil, has since been installed.

Experiments on the bleaching of palm oil, in order to render it suitable for edible purposes for local use, have been commenced and are being continued. Sun bleaching has been found effective but slow. A good but slightly brown-coloured oil has also been obtained by heating the oil for a short time at 240°C. Chemical methods are also being tried, although it is considered undesirable to employ these. It is interesting to note that the oil thickens considerably on bleaching and resembles lard in consistency. A report on the manufacture of soap from palm oil was sent to one estate.

Coconut oil:—An investigation of the moisture and oil content of the "meat" from nuts from a number of high yielding coconut palms is being carried out for the Economic Botanist. The moisture content of 72 samples and the oil content of 18 samples have already been determined. The full report of this work will be published when the investigation has been completed.

A report on the origin and production of Neem Oil or Fat was forwarded to an enquirer. A larger number of samples of vegetable oils was prepared and sent to the Malaya Pavilion, British Empire Exhibition.

Essential or Volatile Oils.

An investigation of the oil content of Lemon grass at the Experimental Plantation, Serdang has been carried out. The oil was found to contain 75 per cent. of citral, which is normal. The results of this investigation were published in the M.A.J. One sample of distilled oil of limes was investigated. Five samples of Patchouli oil were examined in connection with visits paid to two essential oil

distilleries in Johore and Singapore. An article on the cultivation of Patchouli and distillation of the oil was also published in the M.A.J.

Distillations of Vetiver grass roots from the Experimental Plantation Ssrdang were made and the character of the oil determined. Samples of the oil were submitted to the Imperial Institute, through the Malay States Information Agency, and a report was prepared and published in the M. A. J.

A series of distillations of citronella grass from an estate in Selangor were made and the oil examined.

Experimental distillation of the leaves and twigs of the Borneo Camphor tree (*Dryabalonops aromatica*) were carried out and confirmed earlier work carried out by the writer in 1912. No oil or borneol was obtained. The wood of this tree was also distilled and the oil content found to be negligible.

It has been noted previously that this tree yields pure crystals of borneol, an oil consisting chiefly of terpenes and a white resin. The borneol occurs in cavities only in certain trees. An enquiry from a British firm interested in obtaining borneol from this source for the manufacture of synthetic camphor was dealt with both here and at the British Empire Exhibition by the writer. A sample of Pandan leaves (*Pandanus* sp.) was distilled but yielded no essential oil. It is used locally for flavouring purposes.

Samples of various essential oils were supplied to the Rubber Growers' Association for exhibition at the International Rubber and Allied Tropical Products Exhibition held in Brussels in April.

A large number of samples were prepared and sent to the Malaya Pavilion, British Empire Exhibition, Wembley.

An article on the present position in respect of the production of essential oils in Malaya was prepared and sent to the Research Chemist of Messrs. Stafford, Allen & Co., for publication in a new book on the production of essential oils in the Empire.

Gums and Resins.

A report containing observations and recommendations in connection with the collection of Damar minyak, examined at the Imperial Institute was forwarded to the Conservator of Forests.

A preliminary report on a sample of "Malau", an exudation resembling lac, produced by certain insects from local forest trees has been forwarded to the Conservator of Forests and work on this product is being continued.

A report on the production of Carnauba wax was forwarded to an enquirer.

Power Alcohol.

Investigations in connection with the production of power alcohol have been confined principally to the nipah palm, although work has been started on the tapioca (cassava) plant, chiefly to ascertain the mineral constituents of this plant, and its effect on the soil, owing to its supposed exhaustive character in this respect. The tubers of the tapioca plant must be considered as a potential source of alcohol in tropical countries. The work carried out on the nipah palm has included a continuation of tapping experiments on an area reserved at the 15th mile Klang-Kuala Selangor Road, the planting of nipah palms on a small area reserved at this spot and determinations of the sugar content of the juice and methods of preservation in connection with the possible production of sugar from the juice. A report on the work to date was published in the M. A. J. early in the year. The tapping experiments on indigenous palms have been continued during the year.

A visit was paid to Sandakan by Mr. J. H. Dennett towards the close of the year, to inspect the experimental distillery erected for the production of an alcohol-ether fuel from the alcohol obtained from the fermented juice of this palm. This report will be published later.

Sugar.

A small experimental plant for crushing sugar cane grown at the Experimental Plantation Serdang, has been installed on the plantation and investigations have been commenced and are being continued on the sugar content of the various types of cane at different stages of growth and ripeness. A large number of samples of juice have been prepared and examined.

A number of samples of Sisal hemp, Pineapple fibre, Roselle fibre, Arghan fibre, Manila hemp and an unknown bast fibre were examined and reported on.

The extraction of fibre from Sisal hemp grown at Serdang was carried out and samples sent to the Imperial Institute for examination and report and samples distributed among various buyers in Australia.

The reports received from the Imperial Institute and from Australian buyers is being prepared for publication in the M. A. J. Samples of pineapple fibre and Caraguata fibre were also sent to the Imperial Institute for examination and report and the results received recently will be published in the M. A. J.

The investigations carried out by this Division and the reports received show that Sisal hemp of excellent quality can be prepared from the locally grown product.

Soils and Fertilisers.

One hundred and twenty five samples of soils from estates and other areas have been investigated during the year. These include

soils examined in connection with the cultivation of oil palms, nipah palms, rubber, coconuts, padi (rice) and tobacco. Advice on manuring has also been given to several estates. The results of examination of soils from oil palm estates, indicate that a compact soil with a high degree of capillarity is most suitable for optimum development.

Investigations on the salinity of nipah palm soils do not show any close correlation between suitability for this crop and salt content of the soil. The salinity of the soils from mangrove areas was found however to be higher than that of the banks of the tidal rivers.

A Departmental Committee on Soil investigations has been formed and it has been decided to undertake research on soils in certain specific directions in order to obtain more detailed information in respect of tropical soils.

Investigations on the growth of various leguminous crops in pot culture experiments have been carried out and are being continued, also similar experiments on the fertilising value of Perlis phosphates on ragi.

Analyses of Perlis phosphate have been continued and show that the presence of iron and aluminium does not affect the solubility of the phosphate in citric acid solution. A visit was paid to the Perlis deposits by Mr. Greenstreet. Nineteen samples of bat guano from the Gunong Pondok caves have been examined. Some of these were found to contain 36 per cent of phosphoric acid (P_2O_5) and 24.5 per cent of "citric' soluble" phosphoric acid. The fresh deposits contain as much as 10 per cent of nitrate, calculated as nitric acid. A feature of the richer deposits is that they are soft and require no grinding prior to use.

Miscellaneous Investigations.

A number of miscellaneous investigations were also carried out for various purposes.

Reports were sent to various enquirers in connection with (*a* the manufacture of tapioca (*b*) bottling and preservation of lime juice (*c*) distillation of woods in Malaya for the manufacture of acetic acid and other byeproducts, (*d*) manufacture of Citrus products.

Applications for Patents.

Forty seven reports on applications for grants of Exclusive Privileges for inventions were made during the year and forwarded to the Government. A report on the procedure and recommendations in this connection was also forwarded to Government.

Publications.

The following articles were published by members of the staff of the Chemical Division during the year.

The Utilisation of Citronella Grass, planted as a Preventive of Soil Wash by C. D. V. Georgi M.A.J., Vol. XVI, No. 1.

Illipe Nuts and Borneo Tallow by C. D. V. Georgi, M.A.J., Vol. XII, No. 3.

Lemon Grass Oil by C. D. V. Georgi, M.A.J., Vol. XII, No. 3.

Cashew Nut Oil „ „ „ Vol. XII, No. 4.

Patchouli Oil by B. J. Eaton and C. D. V. Georgi, M.A.J., Vol. XII, No. 3.

Vetiver Oil by C. D. V. Georgi, M.A.J., Vol. XII, Nos. 6-7.

Notes on the uses of Raw Rubber by B. J. Eaton and J. H. Dennett, M.A.J., Vol. XII, No. 5.

Papain by B. J. Eaton, M.A.J., Vol. XII, No. 5.

The Utilisation and Waste of Wood in the preparation and packing of rubber by B. J. Eaton, M.A.J., Vol. XII, Nos. 6—7.

The Toxic properties of the Lima Bean by V. R. Greenstreet, M.A.J., Vol. XII, No. 4.

Further report on Nipah Palm by B. J. Eaton and J. H. Dennett, M.A.J., Vol. XII Nos. 6—7.

The Oil Palm in Malaya by C. D. V. Georgi and B. Bunting, M.A.J., Vol. XII, Nos. 6 and 7.

Market Price Lists, M.A.J., Vol. XII, Nos. 4, 6 and 7.

Coconut Palm Products and their uses by C. D. V. Georgi and B. Bunting, " The Planter ".

Potential Agricultural Industries of Malaya by C. D. V. Georgi and B. Bunting, " The Planter ".

Sisal Hemp by R. O. Bishop, H. W. Jack and J. N. Milsum, M.A.J., Vol. XII, No. 11.

Annual Report of Agricultural Chemist 1923, Vol. XII, No. 8.

Recent Development in Oil Palm Machinery by B. J. Eaton, M.A.J., Vol. XII, No. 12.

Views on the Preparation of Plantation Para Rubber by B. J. Eaton, India Rubber Journal, Vol. XLVIII, No. 5, 1924.

Conferences, Exhibitions and Lectures.

The Agricultural Chemist was on duty for two months in the Agricultural Section of the Malayan Pavilion, British Empire Exhibition and dealt with a number of enquiries.

He also paid visits to the following :—

(*a*) The Leather Trade and Boot and Shoe Exhibition in London in connection with use of sole crepe.

(*b*) Two visits to the Rothamsted Experiment Station, in connection with general matters and the investigation of Tuba Root.

(*c*) The Agricultural Development Company's Laboratories, Harpenden, in connection with the manufacture of synthetic farmyard manure.

(*d*) S. F. Edge's Piggeries. Ditchling. Sussex.

(*e*) The Imperial Institute.

(*f*) Cooper's Technical Bureau in connection with the use of Tuba root.

(*g*) The Chemical and Biochemical Laboratories. Cambridge University.

(*h*) Stafford Allen and Company's Laboratories and offices.

The following conferences were also attended (*a*) Imperial Botanical Conference (*b*) Conference at Colonial Office in connection with the recruitment, appointment, and training of Agricultural Officers, as representative for British Malaya.

(*c*) Conference of Rubber Manufacturers, Chemists etc., arranged by the Rubber Growers' Association and the Research Association of British Tyre and Rubber Manufacturers at which he read a short paper on the Preparation of Rubber.

(*d*) Conference arranged by London Chamber of Commerce on " Leather and Rubber " at British Empire Exhibition, as representative of Malaya.

A lecture on " Research on the Plantation " was also read before the Institution for Rubber Industry, London, and two lectures were given in Taiping and Ipoh, on " New Uses of Rubber ".

The following papers were also read at the conference of the Incorporated Society of Planters at Kuala Lumpur.

" New uses for Rubber and new methods of preparation and vulcanisation " by R. O. Bishop.

" Potential Agricultural Industries in Malaya " by C. D. V. Georgi, B. Bunting and Milsum.

" Malayan Soils with references to Rubber and Coconuts " by V. R. Greenstreet.

" Functions of Chemistry in Agriculture " by J. H. Dennett.

A paper on " Naturally occurring fertilisers " was read by Mr. V. R. Greenstreet at the Conference of Malay Officers of the Department.

ANNUAL REPORT OF THE CHIEF FIELD OFFICER, 1924.

By F. W. South.

I. Staff.

THERE were numerous changes among European Officers and difficulties were temporarily experienced in keeping the Senior appointments filled and maintaining efficient supervision. Action has been taken to improve the situation during the coming year.

There were also several changes among Malay Officers, mainly necessitated by training arrangements. The recruiting of Malay Officers was satisfactory for the year, though the whole division is suffering from a shortage of trained officers caused by the necessity for economy in the years 1921 and 1922.

II. Estates Visited.

The following table shows the total number of estates visited throughout the Federated Malay States, the Straits Settlements and Johore :—

Area.	Estates Visited.	Visited by request.	Visited more than once.
Penang & P. Wellesley -	12	4	1
Perak North -	13	4	2
Perak South -	29	17	9
Selangor -	31	16	9
Negri Sembilan -	28	Not recorded.	5
Pahang West -	5	1	—
Pahang East -	5	4	—
Malacca -	15	14	5
Johore -	46	18	13
Singapore -	3	—	1
Additional visits by the Chief Agricultural Inspector-	14	7	—
Totals -	201	85	45

The totals include several other visits by the Chief Agricultural Inspector made in company with the Assistant Agricultural Inspector for the area in which each estate is and consequently entered under that area. The total of 201 estates visited in 1924 compares with a

total of 270 in 1923 and 326 in 1922. The very large majority of these visits were to advise on the control of diseases or pests of rubber, coconuts or fruit trees, but some were to give more general advice regarding budgrafting of rubber and the cultivation of Oil Palm, Coconuts, Coffee and one or two other plants. Advice was also sought regarding cover crops, methods of restoring badly washed soil and manuring of poor soils.

III. Notes on General Agriculture.

1. *Rubber.*

When the year opened the price of standard rubber sheet was about 49 cents per lb., but it fell steadily to about 34 cents, the lowest price being about 31½ cents in May. After the end of July there was a steady rise in price to about 68 cents per lb. in December. The steady rise was accompanied by a regular monthly decrease in the stocks in the United Kingdom which stood at 32,376 tons at the close of the year. On January 1st 1924 the stocks in the United Kingdom were 66,563 tons. Consequently 34,187 tons have been absorbed during the year in the United Kingdom, while in the same period 19,010 tons have been absorbed in the United States. The absorption of these stocks, inspite of an increase in production in the Dutch East Indies, indicates a considerable increase in the worlds consumption of rubber during 1924 and shows that the consumption was in excess of restricted production. The London stocks are now reduced to what is probably a normal quantity, so that they can no longer exercise an artificial depressing effect on prices; consumption is expected to increase steadily during the next few years, while at the same time the rate of increase of more that half of the production is controlled not only by restriction, but also to some extent by the available labour supply. Consequently the condition of the rubber producing industry appears healthier than it has done at any time in the last four years.

The average price realised has been sufficient to provide for the maintenance of estates, in good order and to allow of continued interest in problems of soil conservation and the improvement of poor land.

Enforced restriction has resulted in economy of bark consumption. This has been effected by resting areas of old trees heavily tapped in the past and areas where a comparatively poor soil has caused slow renewal of bark, by postponing the tapping of young areas, and by introducing more conservative tapping systems in practically all producing fields. The result is that there are now in the Peninsula better reserves of good tappable bark than there have been at any time since the larger part of the area planted was first brought into tapping.

Table I shows the stocks in tons in the United Kingdom on December 31st of each of the three years given.

TABLE I.*

Year.	London.	Liverpool.	Total.
1922 ...	72,299	8,782	81,081
1923 ...	59,981	6,582	66,563
1924 ...	29,439	2,937	32,376

Table II shows the stocks in the hands of manufacturers and dealers in the United States on December 31st of the same three years :—

TABLE II. *

Year.	Manufacturers.	Dealers.	Total.
1922 ...	75,678	18,805	94,483
1923 ...	56,523	20,234	76,757
1924 ...	47,010	10,707	57,717

2. *Coconuts.*

The price of copra was $12.50 per pikul at the beginning of the year and remained fairly steady until the beginning of March when a decline began which reached its lowest point at $10.50 at the end of April. Thereafter the price rose again with minor fluctuations to $13.65 in the latter half of October. In November there was another sharp fall to $11.40 at the end of the month followed by a rise to $13/– at the close of the year. The average price for the year was $11.95 as compared with $11.30 per pikul in 1923. The price of nuts in the small holdings varied from 3 to 6 cents each. The price of copra has been sufficient to render the industry prosperous, as it was in 1923.

In Table III are given figures kindly supplied by the Commissioner of Trade and Customs showing the export of copra from the Federated Malay States for the last three years.

*These figures were kindly supplied by the Local Secretary of the R. G. A.

TABLE III.

State.	Quantity in Pikuls.			Value in dollars.		
	1922	1923	1924	1922	1923	1924
Perak	698,934	588,771	647,710	6,624,465	5,788,380	6,914,055
Selangor	214,266	218,911	216,773	1,982,730	2,239,237	2,427,188
N. Sembilan	5,970	8,257	19,805	54,617	85,401	203,930
Pahang	9,449	8,089	9,424	83,753	77,683	95,839
Totals F.M.S.	928,619	824,028	893,712	8,745,565	8,190,701	9,641,012
Johore	416,056	455,675	473,610			

There was thus an increase in production of 69,684 pikuls of copra as compared with that in 1923, the increase being general except in Selangor which shows a slight decrease. Only in Negri Sembilan do the figures indicate any considerable increase of the producing area, the improvement in Perak being apparently mainly attributable to improved yields from existing areas, since the exports of copra for 1924 are not as high as for 1922. The export of copra from Johore in 1924 shows an increase of nearly 17,935 pikuls over the 1923 export and is 57,554 pikuls above that of 1922.

A new factory is in course of erection near Butterworth.

It is noticeable that a large number of the palms in Penang and Province Wellesley are very old and bear very small crops. Many die of old age every month. It is, however, pleasing to record that attention has of late been given to the planting of supplies.

The suitability of this crop to the coastal lands of the Peninsula may again be emphasised, especially as the improved prospects for rubber and the possible counter-attraction of Oil Palm may tend to lead to the neglect of a crop that, properly handled, can be relied upon to give steady and reasonable profits.

3. *Padi.*

(i) Season 1923-24.

The padi crop in Province Wellesley for the season 1923-24 was below the average owing to heavy rain and floods during the growing season.

In Perak North the crop was reduced by rain during the harvest which was late because planting was delayed by drought. The crop

on the Perak river was severely damaged by floods, as it was also in other parts of Perak South, in parts of Selangor and of Pahang West.

The padi in Pahang East was almost entirely destroyed by floods.

In some parts of Negri Sembilan, especially Kuala Pilah district, late planting due to scarcity of water and subsequent damage by the insects *Leptocorisa* spp., M. Pianggang, considerably reduced the crop. In other parts of the State average crops were obtained.

In Malacca the crop was satisfactory and increased yields were reported from the Southern district.

It is noticeable that the yields of padi in Johore tend to be abnormally low. In 1924 an area of 5,728 acres was reported to have yielded 538,744 gantangs, or an average of 94 gantangs per acre. This is partly due to damage by floods in that year, but, in general, insufficient control of the water supply and damage by rats are suggested as factors responsible for the poor yields.

(ii) Season 1924–25.

On the whole the prospects everywhere for the crop of the 1924-25 season are satisfactory, in spite of the fact that in many places planting was delayed by drought. In Province Wellesley planting was delayed by the drying of the nurseries and by subsequent floods which washed away the newly planted padi, necessitating a second planting. The prospects for the crop are consequently somewhat uncertain, as it may be damaged by rain in the late harvest.

In parts of Selangor also floods washed away the young padi and necessitated two or three plantings, thereby delaying the harvest.

The area planted with padi in Pahang East is reported to be small and the appearance of the plants to be poor.

In Malacca there has been an increase in the total area planted and a good crop is expected, although in parts of the coastal area the drought continued so long that planting was very late and portions of some sawahs could not be planted at all.

(iii) Distribution of Pure Strains.

The distribution of seed of pure strains of padi from Titi Serong Station was continued during the season 1923-24. Satisfactory results from this seed were obtained in Perak generally, in parts of Selangor, in Kuala Pilah district of Negri Sembilan and in parts of Malacca. In Province Wellesley and the Central District of Malacca the yields obtained were no better than those given by local varieties, but the pure strains are expected to show considerably improved yields when they have become acclimatised in the course of two or three seasons. In Johore several plots of these selected padis gave yields higher than the local varieties but lodged badly.

In Kuala Pilah district some of the selected strains, although they gave considerably increased yields, were objected to because

their stalks were thin and in consequence the tuai (reaping knife) hurt the reapers' fingers. It is noticeable that in the 1924-25 season, the stalks of these particular strains have been much thicker. On account of the objection to the thin stalks, several planters said they would not use the selected seed again, but actually in 1924 the same areas were planted again and additional areas also.

The value of the selected strains of padi is becoming far more widely recognised, as is shewn by the large demand for them during the 1924-25 season. Seed has now been distributed all over the Peninsula from Kedah and Kelantan to Johore. The following instances will illustrate the above remarks. In the districts of Larut, Kuala Kangsar and Upper Perak 463 gantangs of seed were distributed for planting in 1924, and in Malacca 1350 gantangs, or sufficient for at least 300 acres. In Negri Sembilan 164 Malays had trial plots of these padis and there were 94 growers in Raub and Kuala Lipis districts of Pahang. Owing to the destruction of the crop in Pahang East, the Department provided for seed in 1924, 1600 gantangs of selected and 8,500 gantangs of unselected Radins.

The above distribution by the Department is in addition to local distribution by Malays themselves from seed supplied in 1922 and 1923. Such distribution has been fairly extensive, even outside Krian District, and areas varying from 15 to 100 acres in extent are known that are each planted with a single pure strain. In Krian the distribution has been far more extensive, especially in the north round Titi Serong Station where it is estimated that between 8,000 and 9,000 acres of the best padi land are planted with selected strains.

(iv) Experiment and Test Stations.

The results obtained at the Pulau Gadong Experiment Station in Malacca for the season 1923-1924 were again disappointing, though better than those of the first year, because the soil had not been fully restored to fertility and still required further cultivation. During the 1924-25 season a further 7 acres were brought under cultivation making the total area planted about 25 acres. Moreover there was a very great improvement in the growth of the padi which promised a satisfactory crop. It can now be considered that the Station is well established and that useful results can be expected in the course of the next few years on lines similar to those obtained at Titi Serong. The work in progress consists of :—

(*a*) Tests of selected pure strains of Radins from Titi Serong.

(*b*) Manurial Experiments.

(*c*) Cultivation Experiments.

(*d*) Ear to row selection of pure lines of certain varieties from Negri Sembilan and Malacca.

The work continued at the Padi Test Stations at Permatang To' Jaya in Province Wellesley and at Talang in Kuala Kangsar District

comprised both Manurial Experiments and tests of selected Radins. The results of the manurial experiments will not be available for some years, but the tests show that Radin No. 7 is well suited to parts of the Province and that Radin No. 13 is the best strain for conditions similar to those at Talang.

The experiments for restoring the fertility of reslimed mining land and rendering it fit for padi cultivation were continued during the year on the plots near Taiping and Batu Gajah. The four green dressing crops, *Tephrosia candida*, *Crotalaria usaramoesis*, *C. striata* and *Mimosa invisa* again grew well. *Tephrosia candida* grows slowly at first but later develops into a sturdy shrub which stands cutting back and thus is able to give a periodic supply of material for mulching. It yields little seed as the fruits are attacked by insects. Both Crotalarias make rapid growth. They both seed freely and the self sown seeds of both species germinate and grow, though at Batu Gajah it was found that this natural resowing was not sufficient to re-establish the crop satisfactorily without a little cultivation and artificial resowing. Neither plant will stand cutting back and neither is perennial. *Crotalaria usaramoesis* is the better of the two as it grows more luxuriantly. *Mimosa invisa* was found to make very good growth, especially on the plot at Kamunting, but is considered unsuitable, as its prickles and straggling habit render it difficult to clear off the land without burning and therefore inconvenient to dig in as manure. There is a danger too that it may spread unduly and become a nuisance in places where it is not required. It has been found that its fruits have been carried by running water and have given rise to plants at some distance from the original plot. More extensive experiments with crops that have proved useful are contemplated in the coming year. (M. A. J. Vol. XII. No. 8. p 237.)

4. *Fruit.*

The fruit crops in Penang and Province Wellesley were good in the first half of the year, but became poor in the second half. Throughout the Federated Malay States and Malacca the crops were on the whole poor and in many places there was no definite fruit season such as is usual. In Johore there was a good crop of Durians in Muar district, but the crops were not so good elsewhere.

The fruit supply of the country is certainly not equal to the demand. This is particularly noticeable in Pahang where the supply is very limited and the prices are in consequence high. A considerable proportion of the fruit crop of the southern part of the Peninsula is exported to Singapore, so that even during the season, the markets of such towns as Malacca are poorly supplied with fruit, unless the crops are unusually good.

The Field Division has plans in view for establishing a few small fruit nurseries from which to distribute free good planting material, with a view to stimulating interest in fruit growing and increasing supplies.

Pineapples.—Klang District of Selangor, the southern part of Johore and Singapore island are still the chief centres of pineapple cultivation for canning purposes. The Agricultural Field Officer, Selangor, reports that the total area planted with pineapples in Klang District is estimated at 1,170 acres (estates 268 acres, small holdings 902 acres.) The approximate yield was 428,000 pines for which prices varied from $2 to 2.50 per hundred. A considerable portion of the crop was exported to Singapore.

The Inspector of Agriculture, Johore, reports a continued increase in the canning industry. Six factories were in operation, four in Johore Bharu, one in Kota Tinggi and one in Kubub. The export amounted to 409,142 cases of preserved pines, an increase of over 100,000 cases as compared with the export of 1923. The export figures for 1922, 1923 and 1924 represent about 13,500,000, 32,000,000 and 50,000,000 fruits respectively. A conservative estimate of the area required to supply the fruits in 1924 is 10,000 acres. The price of fruit at the factories has varied from $2.50 to $4.50 per 100 according to season and size. Comparatively large areas of this crop continue to be opened up, rubber being usually interplanted as a permanent crop.

5. *Other Crops.*

Nutmegs and Cloves.

Vigorous encouragement by the District Officer, Balik Pulau, with the co-operation of Agricultural Officers has brought about a revival of interest in these spice crops which were at one time valuable exports from Penang and the Province. The measures taken have been:—

(i) The reassessment at a lower rate of rubber land partly planted with spices, even if part of the rubber has to be cut out to make room for the cloves and nutmegs. This has added about 40 acres to the area planted with spices in Balik Pulau District.

(ii) Co-operation among growers for grading and marketing their produce.

(iii) Attention to cultivation and experiments for the treatment the of the pests have been largely responsible for the decline of the spice industry in the past.

All these measures have met with some degrees of success. The export of cloves has increased in spite of a gradual fall in price, while the increase in the value of mace and nutmegs has assisted the increase in production.

African Oil Palm.—The prospects for this crop are at present very satisfactory. The yields obtained on the one Estate at present in bearing have been up to expectations, although only a small portion of the estate is yet in full bearing. The growth obtained on other properties not yet in bearing has been quite satisfactory. Only about

twelve companies are at present planting this crop and most of these are in Selangor which is the only State in which there has been any appreciable increase in the planted area. Enquiries for land have been received and one or two new companies are about to commence planting operations. Suitable factory plant now appears to be available for areas of varying size from 200 acres upward. There is good reason for the opinion that this crop is well suited to this Peninsula and can be expected to give a reasonable and regular profit.

Betel Nut.—The principal region from which this crop is produced for export is the west coast of Johore. In spite of high prices throughout the year the export from Johore decreased by about 50,000 pikuls. This decrease is mainly accounted for by the fact that large numbers of trees are becoming too old to bear fruit, while the new areas of the crop are not extensive enough to replace them. Though old age accounts for the fact that a number of trees are becoming unproductive, there are indications that disease may be a contributing factor. It seems probable that the decrease in export will continue for several years, as the newly planted areas appear to be far from equal to those becoming unproductive, and this decrease may serve to keep up the price of the produce.

Tapioca.—The price of this crop has been good and there has been an extension of the area planted both in Johore and in parts of Negri Sembilan. Its cultivation is usually combined with pig rearing, as the industry is mainly in the hands of the Chinese. In Johore rubber is usually planted as a permanent crop with tapioca.

Other crops that have attracted some attention on account of improvement in their price are coffee and gambir, while tuba (Derris spp.) is grown on certain Japanese estates in Johore and on a small scale in a few other localities in the Federated Malay States.

IV.—Diseases and Pests.

1. *Rubber.*

Pink Disease. (*Corticium salmonicolor*) :—This disease was newly reported from 20 estates in the Federated Malay States, the Colony and Johore.

As usual the prevalence of the disease depended largely on the rainfall; wet weather towards the end of the year caused a rapid increase in the number of cases in some districts. There was a definite spread of the disease in Selangor from the boundaries of Ulu Selangor, Kuala Selangor and Kuala Lumpur districts near Kuang in a South-westerly direction to the Kuala Lumpur—Klang Road near Seaport Station. Throughout this area cases were comparatively numerous on estates and holdings formerly free from the disease.

Mouldy Rot. (*Sphaeronema fimbriatum*) :—This disease was newly reported from 16 Estates during the year.

In Perak North this disease appeared for the first time at Selama and Ulu Selama in September and at Batu Kurau in November. In Pahang new outbreaks were found at Tras in July and in December at Simpalit near Raub and at Panggong near Kuala Lipis. In Malacca 21 additional mukims became infected; in most the disease was confined to a few holdings only. In Johore during the first half of the year new outbreaks were found at Senggarang in Batu Pahat District, near Sungei Senglang in Kukub District, and at Tanah Merah in Muar district. In September one estate and an adjoining holding were found to be infected in Singapore Island. In most cases the spread of the disease was associated with the movement of tappers from previously infected holdings.

Every effort has been made to teach rubber growers how to recognise and treat this disease and to demonstrate the effectiveness of the treatment in preventing serious damage to the trees. The methods of instruction used have comprised lectures and demonstrations in the field, the distribution of a pamphlet in four languages, and the exhibition in Kuala Lumpur of a cinematograph film.

These measures combined with a certain amount of compulsion, where necessary, have resulted in the regular treatment of diseased trees in all the infected areas, so that the disease now causes but little serious damage. The fact that under restricted production many holdings are only tapped for 6 weeks or two months in each quarter has also assisted in the control of the disease.

Black Stripe. (*Phytophthora sp.*).- This disease was not much in evidence. It was newly reported from 3 Estates in Negri Sembilan.

Root Diseases. (*Fomes lignosus, F. pseudoferreus, Ustulina zonata, Sphaerostilbe repens* and Brown Root Disease) :—These call for little comment, though they are still somewhat prevalent in Johore.

General Sanitation.—A total of 568 notices were served requiring the removal of dead rubber stumps or trunks. Nine persons were prosecuted for failure to obey instructions; all were convicted and fined. For severe wounding owing to bad and excessive tapping 54 notices were served. These gave rise to 4 prosecutions.

2. *Coconuts.*

Beetles. Black Beetle (*Oryctes rhinoceros*) and Red Stripe Weevil. (*Rhyncophorus schach*) :—The routine work of controlling these insects was steadily maintained throughout the year. On the whole it has been successful, though numerous breeding grounds still remain to be destroyed in Penang, Province Wellesley and parts of Singapore island. Persistent inspection is still necessary in Klang and Kuala Selangor districts of Selangor.

Artona (Brachartona) catoxantha.—There were small outbreaks of this caterpillar at Lenggong in Upper Perak and in Krian at the

7th mile on the Tanjong Piandang road, also at Sungei Ayer Tawar in Kuala Selangor District. These all occurred in the first half of the year and were controlled by the natural enemies of this insect. In the second half of the year an Entomologist, Mr. Lee, and the Plant Inspector, Mr. Macnamara, from Fiji visited Malaya in search of insect parasites of *Artona catoxantha* likely to be of service in controlling an allied insect, *Levuana iridescens*, on coconuts in Fiji. Unfortunately at the time of their visit no outbreaks of Artona could be found, and a careful search of previously infected localities failed to discover any of the insects.

Skipper caterpillars (*Hidari irava*) did some damage in Kinta District, at a few places in Kuala Pilah district and in Temerloh district in the first half of the year. Small outbreaks of *Plesispa reichii* were recorded at Kota Tinggi in Johore.

Squirrels annually cause serious losses, by destroying a number of nuts, in several parts of the country, notably in Pahang and to a less extent in Malacca. Efforts are being made to encourage the systematic use of traps and regular hunting to reduce the numbers of these animals. Other animals that do damage to coconuts in the neighbourhood of jungle are monkeys, pigs and bears.

Disease.—The cause or causes of the death of coconut palms on the West coast of Johore referred to in the report for 1923 (M. A. J. Vol. XII p. 224) have not yet been definitely determined, although the matter has received considerable attention. Steps have been taken to ensure the removal of all dead or dying palms and efforts will be made to improve general sanitation on these coconut holdings. A pamphlet in Malay on this subject has been issued.

3. *Padi.*

Leptocorisa spp, M. Chenangau or Pianggang.—These insects did damage to padi at Ulu Selama in Perak during the first quarter of the year. At the end of the year they were reported as a minor pest in Johore. In Kuala Pilah district of Negri Sembilan, however, they became extremely prevalent in many localities during the last quarter of the year and threatened to do very serious damage as they did at Inas and Johol in 1923 (M. A. J. Vol. XII p. 227). Fortunately it was possible to develope a method of catching the adults in large numbers before the eggs were laid. This consisted of dipping old fish nets in a sticky mixture of Kruing Oil and Jelutong, or some other latex such as Getah Trap. "Racquets" made of fine pieces of palm leaf midrib, or bamboo, tied to a long handle, and arranged like the ribs of a fan, were also dipped in the mixture. By waving the nets and 'racquets' over the padi, the insects were disturbed and caught in large numbers. The District Officer induced all owners of padi land in the infected areas to catch the insects by these means. With the vigorous assistance of the Agricultural Field Officer Negri Sembilan, and the Malay Officers of both the Land Office and the Agricultural Department the workers were well organised and the pest was most effectively controlled. Work was still in progress at

the end of the year, but results already obtained were very satisfactory, as it could be seen that the crops had been saved from damage of any importance in all those places where the work had been completed.

Stem borers.—The different species were present throughout the Peninsula from Province Wellesley to Johore at the end of the year, but were on the whole not numerous and did little damage, except at the Experiment Station in Malacca where they caused loss of an appreciable portion of the crop.

Army Worm, Spodoptera mauritia.—This pest destroyed an area of 100 acres of newly planted padi in the mukim of Kota Lama Kanan in Kuala Kangsar District, Perak. The area was replanted and practically no damage was done to the replanted padi.

Nymphula depunctalis.—This insect attacked the padi at the Malacca Experiment Station about a fortnight after it was planted out. It threatened to do considerable damage, especially as the plants were also suffering from the effect of soil acidity, but was controlled by hand picking.

Scotinophora coarctata, M. Bena kura or Kutu bruang.—This pest did a certain amount of damage in the sub-district of Bruas and in Senggang mukim of Kuala Kangsar District. It also occurred at places along the Perak River in Lower Perak District and in Pekan District of Pahang; it was recorded among minor pests in Johore.

The occurence of *Nephotettix bipunctatus* was recorded as a minor pest in Johore. Mole crickets, M. Sesorok, did a little damage in Lower Perak District.

Rats.—These animals damaged padi everywhere, as they do every season. Distribution of barium carbonate at cost price was continued, though in places the supply was insufficient for the demand. Reports on the efficiency of the poison have again varied. On the whole, however, its use is increasing considerably. There is a greater interest among padi growers in the application of methods of destroying rats, including trapping as well as poisoning, and occasionally hunting. Padi growers, however, still fail to realise the necessity for sustained and concerted work.

In order to increase the interest of padi growers in the control of rats and to afford an opportunity for experiments with new methods of control, various forms of bait and the like, a special campaign* against rats was commenced in a definite part of Krian District of Perak on November 15th.

Cotton.—A cotton leaf roller, *Sylepta derogata*, attacked trial plots of a strain of Egyptian cotton in Province Wellesley. The plots were small and the pest was controlled by hand picking. If cotton were planted on a large scale the control of this pest might be a factor of importance.

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*For details see this Journal XIII, No. 6, p. 168.

Achatina fulica.—These giant snails were spreading steadily around Butterworth in Province Wellesly during the first half of the year. However, floods in August killed off many of them, while many others forsook the undergrowth and climbed fences or anything else above water, so that they were easily collected and destroyed. Since the floods very few of these snails have been seen.

5. *Other ests.*

Water Hyacinth.—In the Federated Malay States the destruction of the weed received regular attention, when necessary, and the work calls for little comment. In Negri Sembilan 13 notices were served for its destruction. Three persons were prosecuted for failing to obey instructions; two were convicted and fined a total sum of $30/-.

In Province Wellesley the weed is becoming very prevalent in drains and waterways and is interfering with the drainage of padi fields. It is also spreading considerably in Malacca. In consequence of this legislation has been suggested to enforce its destruction in the Colony on the same lines as in the Federated Malay States.

Mistletoe.—The destruction of various species of mistletoe on different host plants has received attention everywhere, especially in Pahang where these pests are common.

Lalang and Blukar.—Much attention has been paid to enforcing the removal of excessive growths of lalang, blukar and other undergrowth on small holdings during the year, particularly where their presence provided conditions favouring the development and spread of Mouldy Rot of rubber or other diseases. This work continued to meet with a certain measure of success, but it requires continual attention.

TABLE IV.

Summary of Notices Served and Results.

Cause.	Notices Served.	Prosecutions.	Convictions.
Rubber :—			
Pink Disease	1,191	52	50
Mouldy Rot	3,381	327	272
Black Stripe	54	Nil	Nil
Rubber Timber	568	9	9
Bad Tapping	54	4	4
Coconuts :—			
Beetles	2,722	173	154
Water Hyacinth	13	3	2
Mistletoe	84	3	3
Lalang and Bush	8,386	753	689
Totals ...	16,453	1,324	1,183

V. Instruction.

1. On November 15th a re-organisation of the work of the Department came into force whereby the Inspection Division took over all forms of field work, other than that on Experimental Plantations, including all branches of field instruction and work in School Gardens. At the same time the title of the Division was changed to that of "Field Division" (M.A.J. Vol. XII, No. 12 p. 380.)

2. On July 11th, 12th and 13th The Malayan Agri-Horticultural Association held a very successful Show and Trades Exhibition in Kuala Lumpur. Mr. G. E. Mann, Assistant Agricultural Inspector, Selangor, was Organising Secretary. The Inspection Division provided an exhibit of rubber diseases and also assisted in the Agricultural section of which a noticeable feature was the padi exhibit, both for the number of entries, which totalled over 2000, and for their quality. A successful Show was held at Seremban on August 9th at which the Chief Agricultural Inspector judged and the Assistant Agricultural Inspector, Negri Sembilan was joint Secretary. Officers of the Division also assisted at 3 District Shows in Pahang and 3 in Negri Sembilan. At all the District Shows there was a distinct improvement in the quality of the exhibits and also in the organisation.

3. In March the Economic Botanist again gave a demonstration to numerous penghulus and other Malays interested in the work at the Padi Experiment Station at Titi Serong. Officers of this Division attended both to assist and to improve their knowledge of the selected strains of padi.

4. A Conference of Malay Officers of the Department was held on November 18th, 19th and 20th. Papers were read in English and Malay and were discussed by the Officers with considerable interest. The last day was allotted to a visit to the Experimental Plantation, Serdang.

5. This Division has taken over the work in School Gardens too recently to enable a report to be submitted this year.

6. At the close of the third quarter an Advisory Committee for Chinese Agriculture was established with a view particularly to assisting and encouraging Chinese market gardeners and producers of fruit and poultry for local consumption. The Chief Agricultural Inspector was appointed Secretary to this Committee. The Committee held meetings on September 13th, October 17th and November 21st. A Chinese Sub-Inspector of Agriculture was appointed and a considerable amount of preliminary work was done.

VI. General.

In June the Chief Agricultural Inspector visited Palembang Residency, Sumatra, to enquire into the conditions of cotton cultivation there, since this cotton is all sent to Singapore for transhipment. This visit was connected with the revision of the Plant Importation Rules, proposals for which have been completed.

ANNUAL REPORT OF THE ECONOMIC BOTANIST FOR 1924.

By H. W. Jack.

I.—Staff.

H. W. Jack, Economic Botanist; W. N. Sands, Assistant Economic Botanist, who went on furlough in April until the end of the year; Inche Ahmad bin Johar, Junior Agricultural Assistant, a promising officer who unfortunately died on 31.1.1924; 'Che Din, Junior Agricultural Assistant; Inche Mohamed Zain, Probationary Assistant, who acted for Inche Ahmad bin Johar; and Inche Abdul Rauf, Field Assistant.

I desire to express my appreciation of the good work done by the entire staff throughout the year.

II.—Padi.

Experimental work at Titi Serong Experiment Station was continued throughout the year, 'Che Din being in charge. The first two months were taken up with recording vegetative characters of the different varieties of padi grown as foundation stocks before harvest which commenced at the end of March in rainy weather.

The standing crops were heavy but the rains during harvest spoilt much grain, rendering harvesting operations arduous and reducing excellent crops to average ones.

During harvest, the opportunity was taken of demonstrating the returns obtained by growers of selected seed.

In one place in particular where some 40 acres of strain No. 36 had been grown in one block (the result of re-distribution from an original two gantangs of seed), sections of the crop were cut, threshed, measured and weighed, all operations being done in the presence of a a number of cultivators, and it was found that the average yield of the block was 910 gantangs of padi per acre—easily the heaviest in the mukim. When the entire crop from this block was harvested, 40 bags were weighed and the average weight per bag was found to be 109 katis, which is approximately 10% heavier than the weight of an equal quantity of unselected padi.

Just prior to harvest, some 250 visitors from various parts of the country and many local cultivators visited Titi Serong and appeared

to be favourably impressed with the heavy and uniform crops then standing in the fields. The Experiment Station was honoured by a visit of H. H. The Sultan of Selangor and Dato Lee Kong Lam. His Highness seemed to enjoy his visit and showed his interest and knowledge of the rice crop by asking many pertinent questions.

Thirty-four strains were tested for yield in season 1923-24, and from them, fourteen strains were selected for continuation tests in the present season. Of these fourteen strains, five (Nos. 36, 15, 48, 52 and 68) are particularly suitable where soils are soft heavy clays under irrigation, while three (Nos. 2, 7 and 13) are more suited to the harder drier soils, being of shorter maturation period.

In Krian, strains No. 36, 52 and 15 for the deeper soils and No. 2 for the drier soils, were in large demand for seed for the present season ; and 4,700 gantangs of seed were distributed to applicants for sowing in the present season (40% of this amount being No. 36.)

In addition to this distribution from Titi Serong Experiment Station, a considerable amount of natural redistribution has taken place from centres where selected seed was grown in Season 1923-24, so that in the present season it is safe to say that at least 8,000 acres in Krian have been planted with selected seed.

Some 5,600 gantangs of selected seed were distributed to districts outside Krian, to applicants and to Field Officers and others for trial purposes, further trials being made in all the Federated States and in Penang, Malacca, Kedah, Kelantan and Trengganu.

The present season started badly in Krian as a heavy flood in August swept away many seed nurseries. Eelworms and borers were apparent in several areas and rats were unusually destructive to the young planted padi. At flowering, quite a considerable amount of "smut" was apparent but the standing crops promise a good crop. Padi prices, however, are likely to be high on account of the competition which has arisen owing to the increased number of mills in the neighbourhood of Krian, though the bumper crops available for export from Burma may keep local prices of padi down somewhat.

In Malacca, in co-operation with the local Agricultural Field Officer, pure line selection work with types of padi long grown in Malacca was started.

Manurial schemes were drawn up and inaugurated in Malacca and Province Wellesley and maintained in Kuala Kangsar during the present season.

Dry padi cultivation is being tried at Serdang where four good varieties were planted during the present season, with a view to selection of heavy yielding strains.

In Kedah, two strains (Nos. 52 and 7) have already gained favour and this year over 1,000 gantangs of seed of these strains were distributed. Strain No. 13 is already established in one mukim where it was tested successfully in 1920. Strains Nos. 36 and 2 are being tried for the first time this season.

In Trengganu, strain No. P. 1., tried in Season 1922-23 became popular, and a fair area was planted with it this season.

Seven strains are being tested in Kelantan this season—thanks to the assistance of the British Adviser.

In Perak, at Talang Test Station, strain No. 13 maintained its good promise of the previous season and is now widely planted in neighbouring bendangs. Strain No. 1 has spread considerably in several mukims of Kuala Kangsar, while in Lower Perak selected strains (Nos. 36, 7 and 2) were in large demand and now cover quite a fair area.

In the Kuala Pilah District of Negri Sembilan, strain No. 7 yielded heavily in Season 1923-24 and has been planted on a considerable area this season in several mukims.

In Selangor, good crops from selected seed are reported at Klang (strains Nos. P. 1 and 52), and in Kluang strain No. 2 is said to be the best crop in the mukim.

In Pahang, a large quantity of seed was distributed in the Pekan (strains Nos. 7 and 2) and Kuantan (strains Nos. 7 and 13) districts, and though much damage was done by floods, quite good crops were taken in several areas. In Raub several trial lots showed good promise.

In Penang, heavy crops are reported from strain No. 36. In Province Wellesley strain No. 7 is promising well and is gradually spreading from the Test Station there; and strain No. 15 has given good crops.

In Malacca, strains Nos. P. 1., 7 and 11 are gaining local favour, though better results are anticipated from strains of local origin which are now being isolated for selection.

In Johore, strain No. 756 was said to have given excellent crops in the Muar District.

In the present season numerous test plots have been planted with selected padi in many parts of the country and growth is good though results are not yet available.

Some 200 strains of various varieties of padi were maintained as foundation stocks at Titi Serong Experiment Station.

The usual statistics regarding the area under rice and the yields obtained in each district were collected from District Officers and others and are compiled in the following table:—

SUMMARY OF PADI RETURNS—BRITISH MALAYA.

State or Settlement.	1923.			1924.		
	Area in acres.	Yield in gantangs.	Average yield per acre.	Area in acres.	Yield in gantangs.	Average yield per acre.
Federated Malay States.						
Perak -	106,734	24,276,546	227	102,835	23,654,413	230
Selangor -	11,635	1,737,172	149	18,076	4,017,483	222
N. Sembilan -	30,756	5,196,151	169	30,581	5,603,978	183
Pahang -	28,472	4,581,861	161	26,260	3,889,489	148
Total, F.M.S.	177,597	35,791,730	202	177,742	37,165,363	209
Krian -	54,605	14,484,806	265	54,054	14,126,049	261
Straits Settlements.						
Singapore -	...	...	...	...	...	...
Penang -	5,150	2,033,040	395	5,109	2,020,560	395
Malacca -	26,560	7,950,060	300	26,669	9,945,954	373
P. Wellesley -	44,700	14,350,000	321	40,166	13,400,000	334
Dindings -	695	77,475	111	355	35,500	100
Total, S.S. -	77,045	24,410,515	317	72,299	25,402,014	351
Unfederated Malay States.						
Johore -	16,990	840,001	49	8,362	660,125	78
Kedah -	147,009	48,452,102	330	154,568	40,808,870	264
Perlis -	29,125	7,361,920	253	37,738	8,075,600	240
Kelantan -	169,995	33,799,300	199	170,910	34,039,700	199
Trengganu -	11,000	1,700,000	155	12,000	1,700,000	142
Total, U.M.S.	374,119	92,153,323	246	401,166	85,284,295	213
Summary—F.M.S., S.S., and U.M.S.						
Total, F.M.S.	177,597	35,791,730	202	177,742	37,165,363	209
Total, S.S. -	77,045	24,410,515	317	72,299	25,402,014	351
Total, U.M.S.	374,119	92,153,323	246	401,166	85,284,295	213
Grand Total Malaya -	628,761	152,355,568	242	652,207	147,851,572	227

III.—Coconuts.

In connection with the study of variation and selection experiments, individual palm yields of fruit were recorded monthly from 450 palms.

These records, while primarily maintained for the above purposes, will be of considerable utility as supplying data for examining the periodicity of yields and the existence of correlations between rainfall and fruiting and between type of tree and yielding ability.

A study is also being made of the various local and several introduced types with a view to comparison of varieties and classification.

Selection experiments were started on a fifty-acre block of heavy alluvial land near Klang, which was cleared of lalang, drained, holed and planted with seedlings from selected trees. Twenty-five seedlings from each selected parent palm were planted. Except where the germination of the seed nuts was slow or bad the number of seedlings available proved insufficient. To-date about 40 acres have been fully planted, whilst nurseries supplied with seed nuts sufficient for the completion of planting are established.

The plantings include seedlings from 84 palms selected as heavy yielders in the varying conditions of Province Wellesley, Bagan Datoh and Selangor Coast—three of the chief commercial coconut growing areas in Malaya. In addition plantings have been made of 35 lots of seedlings representing 24 different local varieties, 5 Ceylon and 6 Philippine varieties.

A few of the catch crops commonly found in coconut plantations have been planted to test their effects on the coconuts. They include sweet potatoes, tapiocca, ground nuts, coffee, soya bean, chillies and gingelly. Also some of the manures of possible commercial utility, such as lime, superphosphate, guano, salt and fish offal, have been applied to certain groups of palms to demonstrate their efficiency.

Articles dealing with the "Dwarf" Coconut and on "Variation in Coconuts" were submitted for publication during the year.

Efforts were made to verify the statistics of the areas under coconuts given in the Annual Report for 1923. The following figures cannot be regarded as accurate as the areas are, in many cases, calculated from the number of palms, assuming 50 palms per acre as a fair stand, or from copra exports; still, they show the comparative areas in the various States or Settlements and are probably not far wrong.

F.M.S.	acres.	S.S.	acres.	U.M.S.	acres.
Perak	75,281	Singapore	6,565	Johore	92,500
Selangor	62,117	Malacca	45,000	Kedah	27,550
N. Sembilan	6,604	Dindings	6,000	Kelantan	70,900
Pahang	19,400	Province Wellesley	55,000	Trengganu	8,000
		Penang	15,000	Perlis	2,578
Total	163,402	Total	127,565	Total	201,528

	acres.
Total F.M.S.	163,402
Total S.S.	127,565
Total U.M.S.	201,528
Grand Total Malaya	492,495

Of this large area planted with coconuts, 412,272 acres or 83.7% of the entire area consists of holdings less than 100 acres in extent which are almost entirely owned by Asiatic cultivators, showing strikingly the large interest they have in the local copra industry and the production of coconuts for local consumption.

The following table is compiled from figures collected by the Field Officers of the Department:—

Areas of Estates of over 100 acres in extent.		
F.M.S.	S.S.	U.M.S.
61,996 acres.	16,969 acres.	9,013 acres.
Total = 87,978 acres.		

The average yield of copra per acre from 15 representative estates scattered over the Peninsula was 8.22 pikuls in 1923 as against 9.22 pikuls in 1922, showing that, seasonally, 1923 was a poorer year than 1922. Probably 1924 will show a similar average production figure to 1923 as rains have been very frequent throughout the year.

IV.—Cotton.

With the upward tendency in the price of rubber interest in this crop diminished, though trials are being conducted in numerous districts, a few of which show good promise.

The following results were obtained in 1924 under pure line cultivation conditions in poor sandy soil in Kuala Lumpur.

Strain No.	Origin.	Average Wt. of seed cotton per plant in grams.	Calculated Wt. seed cotton per acre in lbs.	Calculated Wt. of lint per acre reckoning 30% lint
				lbs.
1—1	Egyptian	29	390	115
1—2	,,	42	545	160
2—1	,,	37	485	145
3—1	,,	28	365	110
3—2	,,	39	500	150
3—3	,,	46	590	175
4—1	Sea Island	24	310	90
4—2	,,	25	320	95
5—1	,,	14	180	55
5—2	,,	20	255	75
6—1	,,	23	300	90
6—2	,,	39	510	150
7—1	,,	30	390	115
7—2	,,	24	300	90
8—2	,,	9	120	35
16—1	Egyptian	20	255	75
16—2	,,	8	110	35
17	Sea Island	6	70	20
21	Cambodia	13	160	50

The above results are based on plots of 50 plants planted $2 \times 3\frac{1}{2}$ feet on ridges, but the soil was so poor that nearly double the number of plants could have been sown in the same sized plots with beneficial

results. The seed was sown at the end of February and good showery weather was encountered throughout the growing period. The months of July and August afforded ideal harvest conditions. Each strain was the progeny of a single plant selected from previous sowings in 1923. All the seed was gathered from self-pollinated flowers.

The above yields of lint though worked out from rather small plots (and hence possibly misleading) compare quite favourably with yields in the British West Indies, India and America. Better yields have been obtained in better soils where trials have been conducted by planters but no reliable records of actual yields are yet available. In two places, 100 bolls per plant have been reported in small patches.

The weight of seed cotton per plant showed enormous variation on account of the patchy nature of the soil on which the trial was conducted. Some plants yielded over 170 grammes of seed cotton per plant, though the averages as shown are low in most cases.

Pests (Leaf Roller, Cotton-Stainer, Boll-worm, Green Fly) were noticeable in all stages of growth, but were readily controlled.

Samples of lint were sent to the British Cotton Growing Association, Manchester, for report and valuation and some samples were commented on very favourably and highly valued—notably strains Nos. 3-3, 2-1, and 4-2 which were valued at 26d., 26½d., and 27d., per lb, respectively in August 1924.

The best prospects for cotton cultivation appear to be in the Eastern States of the Peninsula where suitable land is available, where more regular and dependable seasons are the rule and where rubber does not dominate the agriculturist.

V.—Rubber.

Little has been done with this crop except to maintain records of individual tree yields of latex. These records have now been maintained for over four years and a summary of four years' figures may be of interest.

A.—Paradise Estate, Kajang.

On the above estate, where the trees were planted in 1896 in rows 10×15 feet apart and were severely tapped up to 10 feet up the trunk during the boom period, extraordinarily high yields were maintained by several trees. The tapping system for the last 10 years has been a V over half the circumference, tapped alternate daily.

The following table shows the groups and frequencies for 394 trees. The yields are given in cubic centimetres of latex and are the averages per tree per tapping over four years. There were 9 test

collections per year, at intervals of 5-6 weeks. The figures show that 47% of the crop is derived from 27% of the trees.

Group.	Frequency.	F. x G.	d.	d^2.	Fd^2.
5	10	50	60	3,600	36,000
15	27	405	50	2,500	67,500
25	41	1,025	40	1,600	65,600
35	44	1,540	30	900	39,600
45	55	2,475	20	400	22,000
55	46	2,530	10	100	4,600
65	31	2,015	0	0	0
75	33	2,475	10	100	3,300
85	25	2,125	20	400	10,000
95	17	1,615	30	900	15,300
105	17	1,680	40	1,600	25,600
115	7	805	50	2,500	17,500
125	6	750	60	3,600	21,600
135	7	945	70	4,900	34,300
145	6	870	80	6,400	38,400
155	4	620	90	8,100	32,400
165	3	495	100	10,000	30,000
175	5	875	110	12,100	60,500
185	3	555	120	14,400	43,200
195	3	585	130	16,900	50,600
205	0	0	140	19,600	0
215	2	430	150	22,500	45,000
225	2	450	160	25,600	51,200
235	1	235	170	28,900	28,900
	N = 394	FG=25,500			Fd = 743,200

$$\text{Mean} = \frac{\Sigma F.G.}{N} = \frac{25,550}{394} = 64.8, \text{ say } 65.$$

$$\text{Standard Deviation} = \sqrt{\frac{\Sigma Fd^2}{N}} = \sqrt{\frac{743,200}{394}}$$

$$= \sqrt{1,886}$$

$$= 43.4$$

$$\text{Coefficient of Variability} = \frac{\text{S.D. x } 100}{M} = \frac{43.4 \text{ x } 100}{65}$$

$$= 67.$$

B.—Seaport Estate, Selangor.

On the above plantation where the trees were thirteen years younger than Paradise Estate, and where the planting distances were 12 feet, by 24 feet, similar data were collected.

The following table shows the groups and frequencies for 209 trees, planted in 1909, and the average yield of latex per tapping per tree in cubic centimetres over a period of four years. Collections were made once every five weeks approximately. These figures show that 55 per cent of the crop was derived from 28 per cent of the trees.

Group.	Frequency.	F. × G.	d.	d^2.	Fd^2.
5	8	40	60	3,600	28,800
15	20	300	50	2,500	50,000
25	17	425	40	1,600	27,200
35	35	1,225	30	900	31,500
45	22	990	20	400	8,800
55	19	1,045	10	100	1,900
65	18	1,170	0	0	0
75	11	825	10	100	1,100
85	10	850	20	400	4,000
95	4	380	30	900	3,600
105	14	1,470	40	1,600	22,400
115	3	345	50	2,500	7,500
125	3	375	60	3,600	10,800
135	5	675	70	4,900	24,500
145	5	725	80	6,400	32,000
155	2	310	90	8,100	16,200
165	3	495	100	10,000	30,000
175	5	875	110	12,100	60,500
185	2	370	120	14,400	28,800
195	1	195	130	16,900	16,900
205	1	205	140	19,600	19,600
215	1	215	150	22,500	22,500
	N = 209	FG = 13,505			Fd^2 448,600

$$\text{Mean} = \frac{\Sigma F.G.}{N} = \frac{13,505}{209} = 64.6, \text{ say } 65.$$

$$\text{Standard Deviation} = \sqrt{\frac{\Sigma Fd^2}{N}} = \sqrt{\frac{448\,600}{209}}$$

$$= \sqrt{2,146}$$

$$= 46.3$$

$$\text{Coefficient of Variability} = \frac{\text{S.D.} \times 100}{M} = \frac{46.3 \times 100}{65}$$

$$= 71.2$$

It is of interest to note that the two areas show a fairly comparable coefficient of variability, though they were of such different

ages and the trees grew under markedly different soil conditions and planting distances.

Moreover, both sets of figures show that approximately half the crop is derived from 25 percent of the trees.

VI.— Cinchona.

Small cinchona nurseries were established on Cameron's Highlands in July and the seedlings, which are doing well, were transplanted to secondary nurseries at the end of the year. Some 2,500 seedlings representing the two varieties, *C. Ledgeriana* and *C. Succirubra*, are thriving and additional primary nurseries are being sown with a view to planting up 3 acres.

Tea and coffee nurseries are also being established on Cameron's Highlands where soya bean, sweet potato and ground nuts produced good crops from small plots sown in July.

VII.—Botanical.

Numerous identifications of plant material were carried out for other officers of the Department, for planters and the police (drugs).

A considerable amount of material, sketches etc., was obtained of various types of "tuba" and "patchouli" for investigation in the near future.

ANNUAL REPORT OF THE MYCOLOGIST FOR 1924.

By A Sharples.

Staff.

THE Mycologist returned from long leave on 12-3-24 and took over from the Acting Mycologist, Mr. A. Thompson ; Mr. F. R. Mason 2nd Assistant Mycologist was transferred to the Inspection Division at his own request, and assumed duties as Assistant Field Officer, Province Wellesley and Penang on 13-6-1924.

Rubber.

General.—In view of the scheme for the formation of a Rubber Research Institute, no work on Rubber other than that in hand has been undertaken. The work in hand will take a considerable amount of time to round off, but any new features have been carefully noted to be utilised according to future developments in Rubber Research.

Since my return from leave two noteworthy features are of interest During the year " change-over" tapping i. e. "Daily Tapping for periods varying from 2 to 4 months, with 2 to 4 months rest following" has been much in vogue. There is no doubt that " Daily Tapping" over a 3 or 4 months period has resulted in a number of calls for advice regarding disease symptoms on the tapping cut, which cannot be placed under any of the better known Bark Diseases. Fortunately Malayan planters are aware of the danger attached to neglect of obscure disease symptoms and in all cases these outbreaks were taken in time and successfully dealt with. Isolation and inoculation experiments were carried out to determine the causal organism if possible, but no success was obtained. After this years experience I would definitely state that, in Malaya, Daily Tapping over a period greater than three months holds elements of danger in view of the decided tendency for fungi usually saprophytic, to veer towards a parasitic habit and that from the point of view of disease prevention Alternate Daily Tapping must be considered definitely superior to Daily Tapping.

The other question of importance is that of *Root Diseases on Old Rubber*, and the question of treatment. On many old areas in Malaya a 10-15 per cent of trees can be found suffering from various root diseases, usually Wet-Rot caused by *Fomes Pseudo ferreus*, some form of Brown Root disease, or Dry-Rot caused by *Ustulina zonata*. If the percentage number of diseased trees rises above a limit such that treatment by removal will cause the yield per acre to fall below an economic level, it would be an unprofitable course to suggest treatment along such lines. Every case of this description needs individual consideration for many factors are involved. What is the lowest economic yield per acre ? What is the benefit derived by the healthy trees after complete removal of the diseased trees etc ? With

reference to the latter question there is some experimental evidence to show that in certain areas reduced to 40 trees per acre, the healthy trees have benefitted to such an extent, as shown by increased yields, that expensive treatment has been amply repaid. But in one case, where results were satisfactory, and a neighbouring estate tried the same policy, no immediate benefits were derived. This again shows the dangers of generalisations in experimental work, where apparently small differences in soil condit ons are liable to influence results to an enormous degree.

Root Disease.

Dealing with specific root diseases, there is little of interest to record. Considerable systematic work has been undertaken recently by Dr. C. van Overeem in Java and as a result it is suggested that Rubber planters lose a friendly old name in *Fomes lignosus* (Kl.) which now becomes *Rigidoporus microporus* (Swart) van Overeem nov. comb. This observer has shown that this common fungus has been given 34 different names by different systematic mycologists, but it is doubtful, if from the applied point of view we can part company with *Fomes lignosus* (Kl.). While the difficulty of stating the accurate systematic position of a disease-causing fungus is of considerable scientific importance for research workers, there is really no reason why planters should not retain a name which has grown into common use since the earliest planting days.

Ustulina zonata and *Fomes Psuedo-ferreus.*

Dr. C. van Overeem has also dealt with these two fungi and has brought forward good evidence for showing that *Ustulina zonata* (Lev) Sacc should be known as *Ustulina Maxima* (Web) Von Wettstein. With reference to *Fomes Psuedo-ferreus* and Wet Root Rot of Rubber, Drs van Overeem and Steinmann have studied a similar disease in Java and conclude that the causal organism is *Ganoderma ferreum* (Berkeley). The writer has been in communication with Dr. van Overeem and has exchanged specimens but cannot agree, at present, that they have brought forward sufficient evidence to consider *Ganoderma ferreum* as the cause of "Wet-Root" Rot in Malaya.

Bark Diseases.

Mouldy Rot.—The situation is practically unchanged from last year. Mouldy Rot has been reported from fresh centres and it seems quite probable that the early fears of continuous spread, as expressed by us in 1920, are likely to be realised. Owing to the bulletin dealing with this disease being out of print, and the continued interest shown because of its appearance in fresh centres, a new bulletin on Mouldy Rot is in course of preparation.

Black Stripe.

Nothing new to record.

Brown Bast.

A bulletin on this subject was issued during the year detailing 4 years tapping experiments. Various interesting observations were made. The evidence favoured the interpretation of a "physiological" disease with excessive extraction of latex as the predominating influence. During the restriction period, there has been practically no demand for advice in respect of this trouble.

Probable New Bark Disease.

This was reported by the Acting Mycologist in the last Annual Report. A short article was written up in the Malayan Agricultural Journal; since this report inoculation experiments have definitely proved the fungus to be weakly parasitic.

Palm Diseases.

The greater part of my time during the year has been spent in studying Palm Diseases. Planting interest in African Oil Palms led to the inception of these studies for little definite information regarding Palm diseases was available up to two or three years ago. The most important study in Palm Diseases was that of "Bud-Rot" a classical instance of an Epidemic Plant Disease.

Bud-Rot.

McRae working in India, has recently published a comprehensive treatise relating to this disease. This work has cleared the position with regard to "Bud-Rot" in the Middle East to a considerable degree. Working chiefly on the Palmyra Palm (*Borassus flabelliferа*), he has proved conclusively that *P. palmivora* (Bull.) is the causal agent of "Bud-Rot" in this palm and also on Coconut Palm. For Malaya the following quotation is of special value "On Palmyra Palms in India "Bud-Rot" is a serious epidemic disease which spreads slowly but can be controlled by systematic measures. Coconut Palms, in districts where the causal fungus is present, *are relatively free from attacks by the fungus.*" This moderate statement by Mc.Rae, based on close association with this problem for several years, differs widely from the usual alarmist statements made when this problem is under consideration.

"Bud-Rot" on mature African Oil Palms had caused a fair amount of trouble on a Malayan Estate and several groups of 6-10 palms were lost yearly. These were destroyed as quickly as possible. but based on experimental work in 1920, it was decided to try to treat mature Oil Palms suffering from Bud-Rot. The first group treated showed surprising recoveries; at the present time no treatment of Oil Palms suffering from Bud-Rot is undertaken and only one palm has been lost over the last three years. There is no doubt about the rotting of the Bud-tissue, but equally certain is the recovery, and the set-back to the tree which naturally follows such an attack, does not appear to influence the course of normal development to any great degree. Coconut Palms do not exhibit the same powers of recovery,

but a fair number of cases have been observed, where recovery has followed treatment of diseased Coconut Palms.

Crown Disease of Young Oil Palms.

This is an affection of young Oil Palms, which in a previous report, I designated as a kind of "Incipient Bud-Rot." It is fairly common on most young Oil Palm estates. The first leaf affected is the fourth from the centre; towards the base, the leaf stalk becomes soft and watery looking, and bends over at this place. Successive leaves are infected until only the youngest central leaves are standing erect. The diseased areas on the leaf-stalks, appear to be carried away from the danger zone, by the rapid growth of the palm leaves, and finally healthy leaves are produced and the palm recovers. This affection would well repay closer investigation, but as no report of the death of young palms from this cause has been received, the matter has to be left owing to pressure of other work.

Diseases of Coconut Palms Confused with Bud-Rot.

In recent years, apparently two new affections on Coconut palms in Malaya have been noted, and these symptoms are usually confused with "Bud-Rot" by Malayan planters. The affections result in a gradual lowering of disease resistance; ultimately the "Bud" becomes involved, and often the top of the tree is blown off. Several cases, however, have shown that characteristic symptoms are present, before the Bud-tissues are involved.

Symptoms No. 1.

Found in most Coconut districts in Malaya. Stem-tissues are soft and discolored, characteristic salmon pink colour with patches of yellowish discolored tissue. No traces of eel-worm and no definite indications of a fungus. A white Bacillus has been isolated on two or three occasions during the last six months but no inoculations have been undertaken.

Symptoms No. 2.

Reported from one district in Malaya as doing considerable damage. Has been found near Kuala Lumpur and at Banting. Stem tissues show a characteristic hardening, all the softer ground tissue elements becoming heavily lignified. The stem tissues are so hard and brittle that it is difficult to fell the trees with an axe. The vascular bundles are stained a reddish-brown colour.

Recently several trees have been found showing a combination of Symptoms Nos. 1 and 2. One case in transverse section showed a soft, outer portion, and a hardened central core, while another case showed a soft central core and the outer part of the stem hardened.

The investigation of these symptoms is proving a complicated one, for now it has to be decided whether the apparently different symptoms are but the results of the attack of one organism, or whether two entirely different diseases must be investigated.

Black Line Disease of Roots of Young Coconuts.

Specimens of diseased roots of Coconut Palms about two years old, have been examined. Faint black rhizomorphic lines were present in the attacked roots and a fungus was isolated from these roots. Preliminary inoculations show this fungus to have slight penetrative powers when placed in wounds in healthy roots. Cultures have been sent home for identification.

Fruit Disease on Oil Palms.

A rather disturbing feature has become manifest on mature African Oil Palms. On the inside of the leaf bases of large numbers of Oil Palms, close to the junction with the stem, pinkish-white rhizomorphic strands are to be found, often bearing fruit-bodies i.e. of a pink-capped Marasmius (?) sp. While commonly present, no damage is done if the fungus remains in its usual place on the leaf-bases. Recently one case has been observed where the fungus suddenly grew up over the mature fruit-bunches, and rendered them useless for oil-production. The common presence of this fungus on the palms and the possibility of the parasitic tendency becoming more common makes careful supervision necessary. It appeared that the trouble might have originated owing to the numerous, non-fecundated bunches being allowed to remain and disintegrate on the tree; usually a few mature nuts are present in such bunches, and as the fungus under consideration appears to be the chief agent in the disintegration of the non-fecundated bunches, it was possible for this organism to to get gradually accustomed to growing into and attacking the oil-bearing nuts. The suggestion to remove the non-fecundated bunches was made and carried out and there has been no further recurrence.

Sireh. (*Piper Betel*).

The above concludes the major investigation under weigh, but some work has been done on Sireh (*Piper Betel*) and interesting results obtained.

Patchouli. (*Pogostemon spp*).

A bad attack of root disease caused by *Fomes lignosus* (Kl.) on Patchouli (*Pogostemon spp.*) was reported from Singapore.

Coffee.

Much interest has been taken in Coffee cultivation and numerous diseased specimens have been sent in for examination and advice. Pressure of other work prevents closer investigation of Coffee diseases under Malayan conditions.

Jerusalem Artichokes.

Some attention has been paid to a serious disease on this crop. The causal fungus has been identified as *Selerotium Rolfsii*. (*Sacc.*)

Aleurites Montana.

Brown Root disease on this crop has been investigated for comparison with Brown Root disease on other crops. The results obtained support the suggestions made by me in 1922, i.e. that Brown Root disease of tropical crops is caused, not by a single species of fungus, but by many different morphological species, which function similarly physiologically.

GROUND-NUTS (*Arachis Hypogea.*)

Work has been undertaken at the suggestion of the Director of the Institute voor Plantenziekten Buitenzorg, respecting resistance of Javan and local varieties of *Archis hypogea* towards attacks by *Bacillus solanacearum.* Up-to-date local varities seem to be as resistant to disease attacks as the proved resistant strains from Java.

The writer has been asked by the Department of Scientific and Industrial Research to assist the Fabrics Co ordinating Research Committee in experiments relating to decay of fabrics. Thirty nine samples of cloth and yarn have been received and exposed under varying conditions.

Two papers were prepared for the Imperial Mycological Conference held in London July and were read by Mr. F. T. Brooks. Other papers were published in the Malayan Agricultural Journal.

ANNUAL REPORT OF THE ENTOMOLOGICAL DIVISION FOR 1924.

By B. A. R. Gater.

Staff.

The Government Entomologist, Mr. G. H. Corbett, was in charge until May 10th, when he proceeded on leave, and also went on special duty at the British Empire Exhibition. After the exhibition he will work for a short time at the Imperial College of Science and attend the Entomological Conference in London. From the 11th May to the end of the year the Assistant Entomologist, was in charge.

The Insectary Assistant, Mr. D. Ponniah, went to India on special leave on September 18th, and reported for duty again on November 30th. Enche Mohammed Yusope, Junior Agricultural Assistant, was at head quarters during the year, and is permanently attached to this Division. I particularly desire to place on record my high appreciation of this officer's services during the period under review. Extremely hard working and enthusiastic, he forms a most valuable addition to the staff.

Organisation.

The Insectary Assistant was stationed at the Serdang Experimental Plantation as from May 1st, for liaison duties. When sufficient apparatus was available at the end of the year he was enabled to begin some investigations. The Junior Agricultural Assistant was placed in charge of the laboratory and subordinate staff. This scheme worked smoothly and enabled a larger amount of work to be completed than would otherwise have been possible.

Visits.

The visiting of estates had to be cut down, and visits were only made where a Field Officer was unable to deal with the situation. The most important visits made by the Ag. Government Entomologist were to Labuan to study the coconut Zygaenid, *Artona catoxantha*, to Penang in connection with the borers in clove trees, and to an estate where a large consignment of barrels was being destroyed by borers. In the last case the barrels which could still be used were freed of the borers (*Dinoderus Minutus*, *F.*) by fumigation with hydrogen cyanide, a special fumigation chamber being erected at small expense. The Seremban Gaol was visited at the request of the Medical Department with reference to a plague of house flies.

Review of Pests in 1924.

There were several outbreaks of *Artona catoxantha* on coconuts. This crop was also attacked in one or two instances by *Hidari thrax*,

Hbn., some damage being done, but all attacks were eventually controlled by parasites. *Plesispa reichei*, Chap. did some damage to young palms.

Padi was attacked by *Spodoptera mauritia*, Boisd., and *Leptocorisa* spp., the damage being fairly serious. *Cnaphalocrocis medinalis*, Guen. was responsible for extensive damage in two instances, although the padi plants eventually made a good recovery.

Among enquiries, those on the pests of coconuts, rubber, oil palm, coffee and castor predominated. A few of the more interesting examples of insects which did some damage during the year are given below :—

Termites, as usual, did considerable damage to buildings, several of which were treated on the advice of this Division. In one instance a telephone cable was damaged, the termites working through the lead outer covering, two coverings of tarred string and in between the interstices of steel tape, finally eating the paper insulation of the telephone wires.

Cantantops sp. prob. *splendens*, Thunb. did some damage to budded rubber, especially in the early stages.

Among the Coleoptera, *Adoretus compressus*, Weber, and *Autoserica* sp. did considerable damage on *Terminalia catappa* and *Isoptera borneensis*, while *Hyrcmeces squamosus* damaged a large variety of plants, notably kapok. *Cylas formicarius*, F. was present in considerable numbers on sweet potatoes. *Apriona flavescens*, Kaup. was found boring in *Artocarpus polyphemia* as well as in Jack fruit. A Cerambycid (*Stromatium longicorne*, *Newm*) did considerable damage to the heavy timbers in a bungalow. Two species of *Odontolabis* were reported to have damaged coconut leaves, but this was not confirmed.

Tobacco suffered severely, in some instances, from the attacks of *Heliothis flavigera*, Hamps., and *Phthorimaea heliopa*, Low., while advice was given on more than one occasion on the prevention of *Lasioderma serricorne*, F. in cheroot factories.

Euproctis sp considerably damaged a cover crop, *Centrosema*. Several Lymantriids are known to feed on rubber, and there is some danger of such insects migrating from the cover to the rubber. Soya beans and ground nuts were attacked by the Gelechiid, *Stomopteryx subsecivella*, Zell., while the larvae of another species of *Phragmataecia*, *P. castaneae*, Hb. were found to be causing considerable damage to sugar cane, especially ratoon crops, by boring the stems.

On several occasions really serious infestations of Coccids were found on fruits such as lime and Jack-fruit, while in particular, *Saissetia nigra*, Nietn. was common on rubber, cotton and croton. Many more cases of Coccid damage came under notice than in previous years, and under plantation conditions these insects may become more serious than in the past.

Of the insects sent in for identification *Sylepta derogata* and *Maruca testulatis* together made up 46 per cent, while a very common and injurious night-feeding beetle, *Apogonia cribricollis*, only totalled 8 per cent. Damage due to the latter occurs at night and the insect is rarely noticed, while the two former insects are collected as caterpillars on the leaves, chiefly of garden plants.

Miscellaneous Activities.

Lectures were given to the Incorporated Society of Planters and to Malay Officers by the Ag: Government Entomologist. In October a course of lectures on Entomology to Malay Apprentices was started and is still in progress. In August a scheme of operations for Locust Campaigns was prepared and a memorandum sent forward with reference to certain precautionary measures necessary in the event of another locust invasion. The scheme is kept in this Division and can be issued to all concerned directly news of a locust swarm is received. The object of this is to provide a course of immediate action based on past experience and up-to-date knowledge of locusts, and so that investigations along definite lines can be started by this Division without delay. Considerable time was spent in assisting the revision of import laws relating to dangerous pests, and it was urged that greater stringency should be used in the control of imports likely to bring in the Mediterranean Fruit fly and the Coffee Berry borer. Messrs. A. M. Lea and C. T. Mc. Namara arrived from Fiji with reference to *Levuana iridescens*, Baker, and endeavours were made to help them in the control of the pest by means of parasites from this country. The position was discussed with them and they were given the latest information available about the parasites they wished to import into Fiji.

Publications.

During the year the following publications were issued by the Division, two, concerning *Artona catoxantha* and a list of economic insects in Malaya, being unavoidably held over until 1925:—

1. "The Two-coloured Coconut Leaf beetle (*Plesispa reichei*, Chap.)" Bulletin No. 34.

2. "*Scotinophara coarctata*, F." Malayan Agricultural Journal, Vol. XII No. 4.

3. "*Batrachedra arenosella*, Wlk. in relation to the Nut-fall of Coconuts." Malayan Agricultural Journal, Vol. XII No. 5.

4. "Annual Report for 1923" M. A. J. Vol. XII No. 8.

5. "The Red stripe Weevil of Coconuts (*Rhynchophorus schach*, Oliv.)" Bulletin No. 36.

6. "Insect Pests of Labuan and Adjacent Islands." M. A. J. Vol. XII No. 11.

Investigations.

The policy of the Division during the year has been to continue in the amassing of a general knowledge of the insect pests of Malaya rather than to make a number of comprehensive studies.

During the year 1107 batches of insects were taken through the breeding cages, representing rather over 6000 individual insects handled by the Division. Of the batches, 15% were parasites, most of which are new to science. Among the pests of crops a number of insects was found to be new, and some have been described by Systematic specialists. Investigations on individual pests had to be curtailed owing to shortage of staff, attention being directed only to the more important. Considerable work was done on *Artona catoxantha*, the insects affecting the oil-palm, and on derris. The life histories of several pests were worked out roughly and a start was made on a study of the Coccidae of Malaya. Efforts were also made to investigate the position of silk as a possible industry in Malaya.

Some Preliminary Results.

Artona catoxantha, Hamps. Work was mainly concentrated on the parasites, of which eleven have now been discovered, in addition to one predaceous insect and the fungous parasite. Of the parasites the most important is a Tachinid, which was described by Dr. Aldrich as *Ptychomyia remota*, new species. *Ptychomyia remota* has been bred on two other caterpillars besides *catoxantha*, and its life history has been roughly worked out. Seven hyper-parasites have been discovered on this insect. Attempts at keeping the pupae of this Tachinid in cold storage for any length of time failed, but it is proposed to conduct a series of investigations on the temperatures influencing it as soon as more material is available. Some striking instances of the apparent influence of fires under coconut trees in inducing outbreaks of *Artona catoxantha* were observed, and meteorological influences were also studied. In one instance *Ptychomyia remota* was taken to Labuan where an outbreak of *catoxantha* was in progress, and where the Tachinid parasite were absent. A summary of observations on *Artona catoxantha* will be published early in 1925.*

Insects affecting the Oil-palm. In addition to insects already reported, the following were found feeding on Oil-palms during the year :—

Anomala dorsalis, F. *Hidari thrax*, Hbn.,

Aleurocanthus gateri, Corbett., & *Setora nitens*, Walk.

Among the insects which have not yet been identified are several Limacodids feeding on the leaves, a Lymantriid caterpillar which eats the young fruits and the larva of a minute moth which may be found in large numbers feeding on the male flowers. Whether the last named is instrumental in killing the flowers and preventing the

*See M.A.J. Vol. XIII No. 4.

spread of pollen, or whether it comes in just after the flower has shed its pollen is not yet certain.

The fact that large numbers of insects are seen round the flowers of African Oil-palms has led certain people to believe that hand pollination might be dispensed with by the cultivation of bees. An investigation was started to ascertain what effect insects had on the pollination, and preliminary results indicate that they have little if any influence. An area of nineteen trees was kept under observation for a month and all insects visiting the flowers were caught daily. In this manner 694 insects were caught at the flowers, but not in a single case was one caught or seen on the female flowers, their attention being exclusively devoted to the pollen.

Derris. Owing to difficulties in the identification of the species of *Derris* the position is in many ways hardly advanced from last year. From tests conducted on insects it appears that there are considerable differences in the toxicities of the various derris plants, but the unreliability of native names has rendered any accurate work impossible. Very shortly however, it is hoped that properly identified plants will be available for study. Some of the plants called "Tuba" in Malay are not *Derris*, but a good collection has been made of all plants said to be poisonous to fish. The number of insects found feeding on the leaves of Derris is considerable, and may influence the production of these plants on commercial lines. The following have been found on the leaves :—

Hesperiidae :—*Hasora alexis*, F. Arctiidae :—*Amsacta lactinea*, Cram. Geometridae :—*Anisodes obrinaria*, Guen. Limacodidae :—*Belippa laleana*, Moore. Thyrididae :—*Striglina scitaria*, Wlk. Pyralidae :—*Maruca amboinalis*, Feld., *Lamprosema diemenalis*, Guen. Eucosmidae :—*Eucosma defensa*, Meyr., and *E. balanoptycha*, Meyr. In addition to these some roots have been found badly damaged by borers but as yet they have not been investigated.

Epilachna indica, Muls. This insect causes considerable damage at times to brinjal, *Datura stramonium*, *D. metels*, french beans and cucurbits. It has also been found feeding on rubber. Females emerging in the laboratory began laying after an interval of 8 days. The eggs hatched after 14 days and the larvae pupated 18 days later. Emergence took place after a further period of seven days, making a total of 39 days from egg to adult. There were three moults during the larval life, the fourth moult giving the pupa. The duration of instars was 3, 5, 4 and 6 days respectively. Another species of *Epilachna*, *E. 28-punctata*, F. var. *pubescens*, Hope, was discovered of on ladies fingers. No parasites have as yet been found on either of these species.

Piezodorus rubrofasciatus, F. (Pentatomidae)—was found in considerable numbers on *Sesbania aculeata* and *Cajanus indicus*. Copulation took place four days after emergence, eggs being laid in

batches of about thirty after an interval of twelve days. The eggs hatched in six days. There were five moults, the period being 7, 5, 3, 6 and 5 days, making a total period of 32 days from egg to adult. No parasites have been observed.

Creatonotus transiens, Walk. is an occasional pest of ragi, vanilla and ground nut. The rate of reproduction is large and the number of food plants is probably not limited. One female laid 1525 eggs in four batches over a period of 4 days. These hatched after 5 days, the larval period varying from 27 to 35 days. The pupal period lasted from 6 to 9 days. For the first three days the larvae skeletonise the leaves only, and they cease feeding two days before pupating. No parasites have been observed.

Brithys crini, F. This Noctuid was found to be doing some damage to *Zephyranthes* and subsequently fed on beans. The largest number of eggs laid by one female was 568. Laying took place two days after emergence, the eggs hatching in 6 days. The larval and pupal periods were from 18 to 22 days and 11 days respectively. During the early part of its life the caterpillar bores the stem, emerging later and feeding on the outside. On beans the green pod seems to be preferred. No parasites have been recorded.

Nyctemia scintillans, Walk. is an omnivorous insect which is fortunately fairly well controlled by parasites. It has been found feeding on the following plants :—

> Castor, ladies fingers, rubber (flowers), candle nut, *Sesbania aculeata*, vanilla, *Aleurites montana*, dadap, cowpea, soya beans, *Eugenia aquea*, *Sesbania grandiflora*, *Pithecolobium dulce* and cabbage.

Up to 233 eggs were laid in batches of varying numbers during a period of 6 days, oviposition starting in from one to five days after emergence. The eggs hatched in five days ; the larval period was 18 and the pupal period 9 days. The larvae are parasitised by three hymenopterous insects. As many as 22 larvae of Chalcidoid No. 1412 emerged from one caterpillar and pupated next day, the pupal period being 6 days. Braconid No. 1418 emerges from caterpillars after the latter have spun their cocoons. Seven have emerged from one caterpillar.

Psara submarginalis, Swinh. This Pyralid is chiefly a pest of tobacco, but has also been found feeding on lettuce and cabbage. Eggs are laid five days after emergence in small numbers over varying periods, up to 69 eggs having been laid by a single female. The eggs hatched in five days and the larval period was from 16 to 20. The pupal period took from 5 to 6 days. An hymenopterous larva was seen in one of the caterpillars but did not survive.

Agromyza sp. prob. *sojae*, Zehnt. No. 1369. The larvae of this minute fly appear to be a limiting factor in the cultivation of

Soya beans. At Serdang certain varieties* showed a difference in susceptibility to attack, one being regularly killed while the other produced a fair stand. This insect has also been found attacking other beans such as french and velvet. Control measures were attempted by means of sand mixed with 3 per cent crude fuel oil, and calcium cyanide. The first prevented the flies ovipositing to a certain extent, but was of little use. Tar oils, which would probably be much more efficient were not obtainable. The calcium cyanide was much more successful but was not applied correctly. Heavy rain fell soon after the application, carrying hydrocyanic acid down to the roots and killing the adjacent rows. The untreated rows down wind, however, were remarkably free from the fly, suggesting that in a country with heavy rains the calcium cyanide should be placed some distance from the beans in the direction of the prevailing wind. Eggs are laid in small cracks in the epidermis of the stems of seedling beans, up to 10 eggs having been observed to be laid at one time, Twenty six larvae have been counted in one plant. The eggs hatched after an interval of about 5 days. All the larvae died in captivity and the larval life was not worked out. Pupal period 8 days. Copulation takes place in from one to three days after emergence.

Two parasites which emerged from the pupae of the fly were discovered, Chalcidoids Nos. 1373 and 1379.

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* Known at the Experimental Plantation as Pahang No. 1 and Pahang No. 2 respectively.

ANNUAL REPORT OF THE AGRICULTURIST, FOR THE YEAR 1924.

By J. N. Milsum,

THE Agriculturist (Mr. F. G. Spring) went on leave on 23rd May, Mr. J. N. Milsum (Ag. Agriculturist, Government Plantations) acted as Agriculturist from that date, in addition to his other duties.

Mr. E. Farquharson (Assistant Agriculturist) assisted the Agriculturist generally at Kuala Lumpur. This officer left the service on 29th August and was succeeded by Mr. H. D. Meads (Temporary Superintendent, Government Plantations.)

Mr. E. Mathieu (Superintendent, Government Plantation) was in charge of the Experimental Plantation and Astana Grounds, Kuala Kangsar.

The Agriculturist acted on the Committee for the management of the Batu Caves Settlement and was Honorary Secretary of the Gardens Committee, Kuala Lumpur during the year.

Experimental Plantations.

The following shows the expenditure and receipts from the Experimental Plantations at Kuala Lumpur and Kuala Kangsar during the year.

Total Upkeep Expenditure, Experimental Plantation, Kuala Lumpur ...	$20,883.77
Total Upkeep Expenditure, Experimental Plantation, Kuala Kangsar ...	5,525.61
Receipts of Rubber Sold ...	6,693.32
,, Plants and Seeds Sold ...	3,134.89
Miscellaneous Receipts ...	190.62
Total Receipts ...	$10,018.83

The amount of Rubber in Store at the end of the year was approximately 636 lbs.

At the Experimental Plantation, Kuala Lumpur, a considerable amount of work was undertaken in connection with terracing and turfing banks and edgings of roads. An avenue of shade trees, (*Peltophorum ferrugineum*) was planted at Swettenham Road, which divides the Plantation. Experimental tapping only was continued and almost the entire crop harvested was disposed of by the close of

the year. The area under rubber was gone through systematically and all necessary pruning attended to.

The Brazil Nut trees continued to make good progress and ten of the largest trees have reached the fruiting stage. From these trees, 165 pods fell and were collected during the year. The nuts were sown in nursery beds and those that germinated were either distributed to applicants or forwarded to the Experimental Plantation, Serdang, for the purpose of planting up an area there. Experiments with germination show that satisfactory results may be obtained by planting the nuts in hot sand-beds as in the case of oil palm seeds. The larger trees were measured at 3 feet from the ground, the average girth was found to be 2' 9," while the largest was 5' 7".

The nuts collected are of good size and flavour and it is considered that the Brazil Nut tree is an introduction of real value.

The work at the Kuala Kangsar Experimental Plantation was mainly in connection with minor crops, and is referred to later in this report.

General Agriculture.

A large number of enquiries were received, as usual, and dealt with. In addition to Rubber and Coconuts, interest was shown in the following crops:—Oil Palm, Tapioca, Coffee, Gambier, Areca Nut, Tuba Root, Patchouli, Pineapple, Kapok, Nipah palm and Fodder Crops.

Rubber.

At the commencement of the year the London Price of ribbed smoked sheet was 1/2 pence per lb. with a local price of 49 cents per lb. The price fell to 10 pence (London) and 31½ cents (local) in May, but rose in the latter half of the year, reaching 1/7⅞ pence (London) and 68 cents (local) in December. The exports of rubber from the F.M.S. for 1924 was 93,507.051 tons as against 101,310.8 tons during 1923.

Coconuts.

The price of copra was $12.50 per picul in January, sinking to $10.50 in April and recovering to $13.65 in late October. At the close of the year the price stood at $13/–. The exports of copra from the F.M.S. for the year was 55,197.1 tons valued at $9,641,012 as against 49,037 tons value $8,190,701 for 1923.

Oil Palms.

Considerable interest in the possibilities of this palm as a large-scale plantation crop was shown. At the end of the year between 5,000 and 6,000 acres of oil palms had been planted in Malaya. This acreage is likely to increase very materially in the near future. During the later part of the year, a modern plant for the extraction of oil was installed on an estate in Selangor. Approximately 295 tons of Oil and 40 tons of Kernels were exported from the F.M.S.

during 1924, as against an almost similar monthly production from the East Coast of Sumatra.

Cover Crops on Estates.

The use of cover crops is becoming more general and considerable attention was given to this subject at the Experimental Plantations. Circular No. 4/24 was issued by the division as a guide to Planters. At the Experimental Plantation, Serdang. almost thirty cover and green manure plants are under trial but of these, the following are so far considered to be the most suitable.

Purpose.	Plant.
Cover for open clearings.	*Centrosema Plumieri.* *Calopogonium mucunoides.*
Cover under shade.	*Vigna Oligosperma.* Sarawak bean.
Soil renovators.	*Tephrosia candida.* "Boga" *Crotalaria usaramoesis.*
Green manure. (for turning into the soil)	*Dolichos biflorus.* Horse Gram.

In opening up new clearings on hilly land, with the use of sufficient silt pits in contour and a strong growing cover crop as *Centrosema Plumieri* or *Calopogonium mucunoides*, almost all surface erosion may be prevented.

Tapioca.

The cultivation of this important crop continues, mainly in Pahang, and outside the Federation in Kedah and Malacca. The exports from the F.M.S. alone during 1924 are as under :—

	Tons.	Value.
Flake ...	2016.6	$831,349
Flour ...	347.0	16,169
Pearl ...	422.14	72,546
Ampas (factory waste) ...	1553.35	20,394

Coffee.

An improved market has resulted in increased interest in Coffees. Generally, the Liberian type has been found to succeed best, but Robusta is grown with success in some districts. Its possibilities as an export crop do not seem very great, having in view the serious competition from Java, and increased planting of the Robusta types in Uganda and other parts of Africa.

Areca Nuts.

Interest has been shown in this crop and attention is being given to the possibilities of its further cultivation. The exports from the F.M.S., during 1924 were 1412.7 tons valued at $249,225.

Other Crops.

As catch crops, Gambier, Tuba Root, and Patchouli have been planted. The price of Gambier has been comparatively high and with suitable conditions i. e., spare labour and plenty of fuel, this crop appears worth consideration.

The market for Tuba Root is uncertain and until satisfactory outlets for this crop are found, its cultivation cannot be recommended. Exports from the F.M.S. during 1924 amounted to 23,431 lbs.

The Ag. Agriculturist served on a Sub-Committee of the Department in connection with Nipah Palm cultivation and some attention has been given to the possibilities of this palm as a large scale crop for coastal and tidal areas. About 800 acres have been planted in Selangor and so far the growth and behaviour of the palms under cultivation has been satisfactory.

Experimental tapping carried out by the Chemical division at the experimental block at Jeram, shows promise of Nipah as a satisfactory source of power alcohol and sugar. Further developments with this palm in Malaya will be of interest but as yet it is a matter of uncertainty whether there is sufficient land or natural areas for any considerable extension.

Pine-Apples.

A visit was made to several Chinese Pineapple Estates in Johore and the system of cultivation and packing examined. Three problems, connected with this crop, require attention, namely, improved packing, variety of Pineapple, and crop rotation. An important consideration in marketing tinned fruits, is an attractive container, and should it be found possible to export a higher class Pineapple than at present, a distinctive label and careful packing will do much to popularise Pineapples from this country.

A large number of pineapple varieties have been secured from various sources and the experimental trial of these on a field scale at the Experimental Plantation, Serdang, is work of considerable importance.

The treatment of land after cropping with pineapples is a difficult problem, the usual system in the past being to interplant rubber. A suitable rotation or methods of bringing the land back to a sufficient state of fertility is a very necessary adjunct to the culture of a crop of this nature and it is hoped to be able, at a later date, to make recommendations, based on experimental work in progress. The export of tinned pineapples from the F.M.S. for the year was 3,949 tons value $732,190.

Sisal Hemp.

The Ag. Agriculturist served on a Departmental Fibre Committee and considerable work was undertaken with Sisal Hemp. The results were published in the November number of the Malayan

Agricultural Journal. It is sufficient here to say that this crop is well suited to Malayan conditions and might equally well be grown profitably in this country as in Sumatra, which country is now exporting over 1000 tons of fibre a month.

Investigations are in progress to ascertain the possibilities of this crop as a rotation following Tapioca.

Long-Staple-Cottons.

Small plots of Sea-Island and Egytian Cottons were tried at the Experimental Plantations, at Kuala Lumpur, Kuala Kangsar, and Serdang. The results from the latter Plantation are included in the report of the Ag. Agriculturist, Government Plantations, for 1924. In all cases these cottons failed completely and I consider it an unsuitable crop for this country, at least on the Western side of the Peninsula.

Fodder Grasses.

Investigations were carried out during the year, mainly at Serdang, and a paper on the subject was published in the December number of the Malayan Agricultural Journal. A Circular (No. 3 of 1924) was issued and distributed ; this has resulted in numerous enquiries for planting material. As a cut fodder, Guinea grass has proved most satisfactory and 62,000 plants were distributed. Carpet grass recently introduced by the division from America, has proved an excellent general utility grass and a large amount of material was distributed. A paper on this grass was contributed to the Malayan Agricultural Journal, Vol. XII, No. 12, December, 1924.

Annual Crops.

Lima beans, Soya beans, Ground Nuts, Tobacco and Maize were cultivated at the Experimental Plantation, Kuala Kangsar, Mr. Mathieu succeeded in growing remarkably good crops of these, but it is a matter of considerable uncertainty whether the cultivation of most annual crops is likely to be profitable on other than a small scale. The rainfall experienced at Kuala Kangsar (68.5 inches during 1924) was comparatively low and in addition the soil is particularly suited to the cultivation of such crops. It is to be appreciated that the conditions of the greater part of the Peninsula are essentially those of a rain forest country, i. e., a heavy rainfall distributed throughout the year with uncertain seasonal variations. This, combined with the comparatively poor soils and numerous insect pests, makes the cultivation of annual crops, excluding Padi and Maize, a matter of considerable uncertainty. Present investigations indicate that such crops must be considered in the nature of market gardening, requiring intensive culture. Possible exceptions are Ground Nuts and Gingelly which under suitable conditions frequently yield good returns. The import into the F.M.S. of Ground Nuts is so heavy that it is curious that this crop is not cultivated in quantity. This, however, may be

due to the comparative smallness of the population in the Peninsula. The imports for 1924 are as follows :—

	Tons.	Value.
Ground Nuts ...	1070	$ 194,788
Ground Nut Oil ...	2534.25	1,139,791
Gingelly Seed ...	26.45	103,298

Fruits.

A large number of fruit trees were raised at the Experimental Plantation, Kuala Lumpur, and distributed during the year. Arrangements have now been made to transfer this work to the Experimental Plantation, Serdang, with the object of fruit improvement and distribution of selected stock.

General.

A number of visits were made to Estates and advice given on matters of general agriculture. A visit was made to the farm attached to the Central Mental Hospital, Tanjong Rambutan, Perak, where highly satisfactory results are obtained in the cultivation of a variety of food crops. This institution has been supplied with a considerable quantity of planting material. Visits were made to Fraser's Hill, Pahang, and horticultural plants supplied for planting on the Hill Gardens.

Note :—The Customs Department, Federated Malay States, has kindly supplied the export figures in this report.

ANNUAL REPORT OF THE AGRICULTURIST, GOVERNMENT PLANTATIONS FOR 1924.

By J. N. Milsum.

Mr. B. Bunting, Agriculturist, was in charge of the Government Plantations; Pondok Tanjong, Kuala Tembeling, Castleton Estate, Telok Anson, the Coconut Plantation, Sapintas, and the Experimental Plantation, Serdang, until he went on leave on the 26th April, when Mr. J. N. Milsum, Assistant Agriculturist, took over the acting appointment.

Mr. T. D. Marsh, Assistant Agriculturist, was stationed at Castleton Estate, Telok Anson.

Messrs. E. A. Curtler, Assistant Agriculturist, and J. Lambourne, Superintendent, Government Plantations, assisted at the Experimental Plantation, Serdang.

Mr. J. N. Milsum returned from leave on the 29th March.

Mr. J. Lambourne was promoted to the appointment of Assistant Agriculturist as from 1st October.

Expenditure and Revenue.

The following shows the expenditure and revenue, of the Government Plantations, during the year under review.

Expenditure.

Government Plantation, Pondok Tanjong	...	$35,761.80
,, ,, Kuala Tembeling	...	18,638.98
,, ,, Sapintas	...	49,433.83
Castleton Estate, Telok Anson	...	29,551.36
Experimental Plantation, Serdang	...	91,388.44
Total	...	$224,774.41

Revenue.

Government Plantation, Pondok Tanjong	...	$60,114.02
,, ,, Kuala Tembeling	...	7,975.49
,, ,, Sapintas	...	12,596.16
Castleton Estate, Telok Anson	...	45,708.25
Experimental Plantation, Serdang	...	1,089.44
Total	...	$127,483.36

The total expenditure of the Government Plantation for the year was $224,774.41 as compared with $200,536.12 in 1923, which is an increase in expenditure of $24,238.29, whilst the total revenue for the year was $127,483.36 against $88,342.59 in 1923, or an increase in revenue of $39,140.77.

The Government Plantations at Pondok Tanjong, Kuala Tembeling and Sapintas ceased to be supervised by the Department at the end of the year and were placed under the management of the Planters' Loans Board, F.M.S., as from 1st January, 1925.

The divisions of the Government Plantations, F.M.S. and Agriculturist, S.S. & F.M.S. were then reorganized Mr. Bunting being placed in charge of the "Agriculturist" Division with Mr. J. N. Milsum acting until the former's return from leave, while Mr. F. G. Spring was placed in charge of the Division of Agriculture "Rubber."

GOVERNMENT PLANTATION, PONDOK TANJONG.

Mr. F. M. McCormac was in charge of the Plantation until 29th May when he went on leave. Mr. C. Gwatkin Williams was appointed Manager as from that date and remained in charge during the remainder of the year.

The area of the Plantation is approximately 307 acres, made up as follows :—

Mature Rubber	 293	acres.
Building Sites	... 7½	,,
Waste Land	... 6½	,,

The New Clearing (300 acres, unplanted) was sold by Public Auction on the 21st January, 1924, for the sum of $30,000/-.

The plantation has been maintained in good order and attention given to the removal of all untappable trees. The drains throughout the estate have been cleared periodically and all bridges kept in good repair.

The labour force at the end of the year was 54 males, 21 females and 27 minors, a total of 82 Indian coolies. The average daily wage was 41.68 cents per day.

The health of the labour force has much improved, there being 81 admissions into hospital against 139 last year. There were three deaths, two occuring in Taiping Hospital. One coolie was killed on the plantation by a tiger.

The tapping system has remained the same as in 1923, i.e., one cut on a quarter alternate day except Fields 2, 4 and part of 5, which is a single cut on a third on alternate days.

At the close of the year there were 18,538 trees being tapped out of a total of 23,256. The average stand of trees per acre was 79.6.

The crop for the year was 80,897 lbs. of dry rubber, comprising 84.63% No. 1 Ribbed Smoked Sheet and 15.37% lower grades. The cost of tapping and collecting was 4.38 cts. per lb. as against 5.14 cts. in 1923. The "all in" costs for the year were 36.9 cts. per lb.

There were fifteen consignments forwarded to the Singapore Auctions during the year and many gained the Standard Award for Smoked Sheet. The average price realised for the year was 48.73 cts. per lb.

Diseases and pests have, as usual, been troublesome, but have been kept well in hand.

It was an abnormally wet year, rain being recorded on 203 days, registering a total of 156.19 inches as against 127.69 inches in 1923.

Government Plantation, Kuala Tembeling.

Capt. F. J. Ayris was Manager of the plantation throughout the year.

The area of the plantation is approximately 930.62 acres, which is made up as follows :—

Mature Rubber	...	350.98 acres.
Immature Rubber	...	93.17 ,,
Clearings (not planted)	...	22.37 ,,
Building Sites	...	9.11 ,,
Reserve Land	...	454.99 ,,

No tapping was undertaken during the year.

The two cover plants (*Centrosema Plumieri* and *Vigna oligosperma*) in the mature areas continued to do well, the latter cover having always been very successful on this plantation, even under heavy shade.

The labour force at the close of the year consisted of 39 · 10 females and 1 minor or a total of 50 Tamil coolies.

It was found necessary to reduce the labour force during the latter part of the year to keep the expenditure within the estimate.

The general health of the coolies was fair. There were 48 admissions to hospital and two deaths during the year.

It was found necessary to undertake considerable repairs to lines and other estate buildings and, with the exception of the Manager's bungalow, all buildings were in good order and repair at the close of the year.

Disease was kept well under control ; a number of cases of Pink disease (*Corticium salmonicolor*) receiving the necessary attention.

During May and again in July considerable damage was done by elephants, 74 dwarf coconut palms being destroyed.

Rain was recorded on 190 days during the year, giving a total rainfall of 92.44 inches.

Castleton Estate, Telok Anson.

Mr. T. D. Marsh, Assistant Agriculturist, was stationed at Telok Anson, and was in charge of the estate during the year.

The area of the estate is 207 acres, 2 rods, 35 poles, which is made up as follows :—

Mature Rubber	...	196.9 acres.
Coconuts	...	6.3 ,,
Building Sites	...	4.5 ,,

The cost of weeding the whole estate, other than the area under cultivation experiments, was $2.95 per acre or 24.58 cts per acre per month. This figure includes weeding in the coconut area and manurial experimental block, which areas produce a rather heavy growth of weeds.

The labour force at the close of the year consisted of 76 Tamil coolies. The average daily check-roll wages throughout the year was 39.85 cts. per coolie.

The general health of the labour force was good. There were 8 admissions to hospital during the year and of these three died. Two deaths were due to digestive trouble with infants and in one case the child of a new coolie died of malaria.

General repairs were carried out to buildings and all were in good repair at the close of the year.

The estate was tapped throughout the year on one cut on a quarter daily, with the exception of the two experimental plots which were tapped on a V alternate days. The total number of trees at the close of the year was 15,477 or an average stand of 75 trees per acre, excluding the 19.6 acres under a thinning experiment where there is an average of 114 trees per acre. A total of 330 trees were removed during the year of which 307 were cut out during the process of thinning. The remaining 23 were removed owing to disease.

The amount of dry rubber harvested during the year was 93,570 lbs. as compared with 83,137 lbs. in 1923. The average yields during 1924 and 1923, are as follows :—

		1924.	1923.
Yield per tree per annum	...	6 lbs.	5.21 lbs.
Yield per acre per annum	...	475 ,,	423 ,,

The average cost of tapping and collecting, including utensils, was 6.84 cts. per lb. against 7.49 cts. per lb. in 1923. This comparatively high cost is due to the experimental work limiting the number of trees tapped per coolie. The "all in" cost of production was 27.81 cts. per lb. as compared with 28.50 cts. in 1923.

The crop harvested was sold at the Singapore Auctions and the average price realised for all grades was 48.27 cts. per lb as against 46.83 cts. in 1923.

A new Semi-Diesel Tangye, 30 h.p. engine was purchased through the Crown Agents, London, and installed in February. The installation of the new engine resulted in a considerable saving in charges under manufacture. The cost of coagulation and manufacture during the year was 3.67 cts. per lb. against 5.16 cts. per lb. for 1923.

The drains throughout the estate have been cleared and where necessary deepened. A number of new subsidiary drains were cut in the manurial plots. The whole of the estate is now thoroughly drained.

The various experiments as under the following headings were continued throughout the year.

Cultivation Experiments.—Various experiments with cultivation covering 30 acres have been recorded continuously since March 1913.

Tapping Experiments.—Right and left tapping experiments were commenced in December, 1915, and continuous records have been taken.

Alternate day tapping.—Yields from daily versus alternate day tapping and early tapping versus late tapping are recorded.

Individual Yields.—Yields have been recorded from 100 old trees for the past two years and four months.

Thinning Experiments.—These experiments over about 40 acres were commenced in January 1917.

Manurial Experiments.—The results from a number of manurial experiments over an area of 40 acres were completed during the year. A fresh manurial experiment over 47 acres was laid down early in the year and the necessary data recorded.

The land under coconuts was planted with a variety of cover plants to provide demonstration plots.

A change of tapping was decided on for 1925 and it is anticipated that with a more conservative system, the affected trees will gradually recover and the disease be less prevalent. A few trees were lost through *Sphaerostilbe repens.*

Rain fell on 191 days during the year, giving a total rainfall of 101.36 inches. The wettest month was November with a rainfall of 14.51 inches. The heaviest rainfall in a day was 3.80 inches on November 6th. The dryest month was August with a rainfall of 1.40 inches.

Government Coconut Plantation, Sapintas.

Mr. F. G. Parkin, Manager, returned from leave on the 10th January and took over charge from Mr. R. R. Hartley as from that date.

The area of the plantation is 2,122.5 acres, which is made up as follows :—

Coconuts	...	973.4 acres.
Rubber	...	88.6 „
Cleared but not planted	...	40.0 „
Felled and part cleared	...	56.1 „
Building Sites	...	17.3 „
Waste Land	...	45.5 „
Reserve Jungle	...	901.6 „

A census of bearing and flowering palms was taken in July showing the following figures :—

Palms in bearing	...	13,241
Palms in flower	...	6,014
Acres in bearing	...	251 acres.
Total acreage	...	938.1 „
Immature acreage	...	35.3 „

A census of rubber trees was taken in July showing 5,545 tappable trees as against 4,370 in 1923.

The experiments with various legumes and other plants as cover crops were continued, the following plants being tried out for this purpose :—*Centrosema Plumieri*, *Mimosa invisa*, *Clitoria cajanifolia*, *Vigna oligosperma*, *Tephrosia candida*, *Tephrosia Hookeriana var. amoena*, *Passiflora foetida* (Passion flower) and *Ipomoea batatas* (Sweet Potato). The area under experiment, including the 4 clean weeded controls, was approximately 72 acres.

The roads have been kept clean, and the bridges in good repair during the year.

Considerable attention was given to the drainage system, and where necessary the drains were cleaned out and deepened.

The new water-gate in Fields 3/4 had not been completed at the end of the year.

Fresh seedling palms were supplied, a total of 2,480 have been planted during the year.

Pigs and bears have been a source of trouble, the former destroyed a number of young seedlings, and the latter a number of large palms on the South and West boundary fields. White ants continued to give trouble but were kept well in hand. Several palms were destroyed by beetles and bud-rot.

The labour force at the close of the year consisted of 150 men, 56 females and 35 minors; a total of 241 Tamil coolies.

The average daily check-roll wage for the year was 37.65 cts. per coolie.

All buildings were kept in thorough repair during the year. A Ceylon pattern brick copra kiln capable of dealing with 3,750 nuts a day was completed in July. The kiln has proved very satisfactory and first quality copra is now made. A cement floor for use in splitting the nuts and preliminary drying was also completed.

A crop of 380,038 nuts was made into copra, realising 1,387 piculs, 84 katties nett copra. which sold for an average price of $11.79 per picul. The average number of nuts to the picul was 26.9 which included a number of nuts from dwarf palms. A total of 1,319 nuts was sold locally. The total amount realised for the sale of copra and nuts was $16,357.83 against $8,939.48 in 1923. The average cost of harvesting and manufacture of the copra was 73 cts. per picul. Since the new kiln was used, a considerable reduction in cost was effected.

Rain fell on 168 days, giving a total rainfall of 90.08 inches against 84.28 inches in 1923.

Experimental Plantation, Serdang.

The object of the plantation is the testing out of all crops, other than rubber, coconuts and padi and the supply of planting material of economic plants in the Peninsula. In addition, it is proposed to transfer to Serdang the work on fruit, previously carried out at the Kuala Lumpur, Experimental Plantation. It is also proposed to commence preliminary work on Stock Farming early in 1926.

Two Assistant Agriculturists were stationed on the plantation during 1924 and it is proposed to increase the European staff to four, though leave arrangements will result in one such officer being absent for the present.

A list of crops and other economic plants established at the Experimental Plantation at the close of the year was published in the Malayan Agricultural Journal (Vol. XIII, No. 1) and also issued as

Departmental Circular No. 1/25. The list comprises 165 species of plants.

The following crops are those considered of major importance and of possible suitability as plantation crops on the plains in this country.

List of Major Crops.

Tapioca	...	Manihot utilissima
Pineapple	...	Ananas sativus.
Coffee	...	Coffee spp.
Oil Palm	...	Elaeis guineensis.
Sisal Hemp	...	Agave sisalana.
Clove	...	Eugenia caryophyllata.
Nutmeg	...	Myristica fragrans.
Gambier	...	Uncaria Gambier.
Areca Nut	...	Areca Catechu.
Tuba	...	Derris elliptica.

Research work on fodder grasses was undertaken during the year and the results obtained were published in the Malayan Agricultural Journal (Vol. XII No. 12). The following grasses have proved so far the most suitable fodders under trial.

Fodder Grasses.

Guinea Grass	...	Panicum maximum.
Napier Grass	...	Pennisetum purpureum.
Mauritius Grass	...	Panicum muticum.
Dallis Grass	...	Paspalum dilatatum.
Carpet Grass	...	Axonopus compressus.

Attention was given to the food crops of the Peninsula, other than padi and garden vegetables. The following list shows the most important food crops that were under trial.

Food Crops.

Greater Yam	...	Dioscorea alata.
Lesser Yam	...	,, esculenta.
Ragi vars :	...	Eleusine coracana.
Sweet Potato vars :	...	Ipomoea Batatas.
Tapioca vars :	...	Manihot utilissima.
Maize vars :	...	Zea Mays.
Groundnut vars :	...	Arachis hypogaea.

The area of the plantation is approximately 1,525 acres of which 570 acres had been opened up by the end of the year. Provision has been made in the 1925 Plantation Estimates for a detailed survey of opened area.

The following more important crops were planted up during the year under review:—Coffee 3½ acres, Groundnuts 8 acres, Gutta-percha 1 acre, Tapioca 5 acres, *Elateriospermum Tapos* (Prah) 5 acres, Manila Hemp 10 acres, Caraguata fibre 4.66 acres (part of 10 acre block), Tuba root 4½ acres, *Acacia farnesiana* 1 acre, Mauritius grass 1 acre, Sago palm 3 acres, Oil palm 17 acres, Sisal Hemp 8½ acres (part of 10 acre planting distance experiment plot). An area of approximately 5 acres of "blukar" adjoining the Kapok area was cleared in preparation for planting lowland tea. Seed of four "jats" of tea were obtained from Assam and raised in the nursery.

Approximately 100 young trees of economic importance were planted in the arboretum during the year.

Fifty four species of plants were introduced, including three new cover plants and two fodder grasses which show considerable promise. Five varieties of tapioca were received from Java and nine additional varieties of pineapples. Seed of ten selected varieties of Coffee were purchased from Java, and a large number of seedlings are available for planting out in 1925.

The following experiments with oil palms were commenced but definite results were not available at the close of the year:—artificial pollination, pruning, germination.

To test the effect of tapioca on land as a crop, the following experiment has been started:—

A block of flat land has been divided up into ten areas of 1 acre each. The land is planted with tapioca cuttings at the rate of two acres a month to facilitate harvesting. Eight acres have been planted to-date.

Previous to planting, samples of soil from each block were collected by an officer of the Chemical division for the purpose of analysis. This work is in hand.

As the first crop of roots is taken off the land, a further planting programme will be instituted, accompanied by experiments in manuring, both artificial and by means of green dressing. In course of time, information on the following points should become available.

(*a*) Constituents taken from the land by tapioca.

(*b*) Number of crops and yield possible on the same land without manuring.

(*c*) do with artificial manuring.

(*d*) do with green manuring.

(*e*) Suitable rotations.

(*f*) Yield and subsequent crops of tapioca after rotation.

It is proposed to duplicate this experiment on hilly land.

Large consignments of Sisal, Pineapple, Mauritius and Caraguata leaves and a few stems of Manila Hemp were sent in to the Chemical division for the purpose of preparation of samples for valuation and report.

A large quantity of planting material was forwarded to headquarters for distribution to applicants and use by officers of the Department. At the end of the year arrangements were in hand to distribute planting material of Groundnuts, Pineapples and Sweet Potatoes to Malay small-holders throughout the Peninsula, the officers of the Inspection Division acting as distributing agents. The material was sent out late in 1924 and in January of 1925. It comprised 460 lbs. of Groundnuts, 7,460 Pineapple suckers and 2,060 lbs. of Sweet Potato tubers.

The Public Works Department completed the new entrance road to the plantation in March. This is a great improvement on the old road through Serdang Estate and has shortened the distance considerably.

Further progress was made in the construction of connecting roads on the plantation. The majority of such roads west of the central avenue have been completed. An avenue of Rain trees was planted along the central road. Culverts and concrete pipes have been laid to carry the roads over drains where necessary. The entrance road and main avenue were joined up. This has added very considerably to the appearance of the plantation which is now taking definite shape.

A considerable amount of drainage work was undertaken during the year, the newly opened area being divided into 10 acre blocks by suitable drains. A new boundary drain was dug on the western boundary of Serdang Estate, with an outlet into the drain adjoining the side of the new entrance road. Further drains have been cut in this area to relieve the pressure of water in the drain on the eastern boundary of the plantation.

The following new buildings were erected on the plantation during the year :—

1 Set Cooly Lines 20 rooms.
2 Single Garages for Bungalows No. 1 and 2.
2 Cooly Line kitchens.
1 Cooly Line latrine.
1 Implement Shed.
1 Manure Shed
1 Quarter for Conductor.
1 Quarter for Watchman.
1 Seed Store.
1 Cement Drying Ground.

All existing buildings have been maintained in good repair.

The levelling of the Factory site was continued as opportunity occurred.

The labour during the year was mainly non-resident Chinese coolies engaged locally. These were supplemented with Tamils recruited from the coast. The Indian labour force was increased from 57 at the close of 1923 to 193 at the end of the year. The average number of coolies employed daily during the year was 370.

The health of the coolies living on the plantation was fairly good. The weekly oiling of all drains, which was commenced in October 1923, has resulted in there being few cases of malaria fever.

Insect pests have been very troublesome with almost all the crops. A pest gang was employed constantly in the collecting of insects by hand or spraying. The Insectary Assistant to the Entomologist, was stationed at the plantation from May 1st and was employed in pest work until he went on leave in September.

Crown disease of oil palms was prevalent during the year, but no permanent damage so far appears to result from this disease.

The average maximum temperature recorded during the year was 90.5°F. and the average minimum temperature 70.2°F., the highest maximum being 97°F and the lowest minimum 64°F.

Rain fell on 241 days during the year, giving a total rainfall of 92.37 inches as against 81.94 inches in 1923.

Records were taken of the wind velocity on the plantation by means of a cup-indicating anemometer.

A large number of visitors were shown round the plantation during the year. H. H. The Sultan of Selangor and staff, and about 60 Malays visited the plantation in January. The Incorporated Society of Planters paid a visit on July 14th when 29 members signed the visitors book. The Advisory Committee of the Department held a meeting on the plantation in December.

ANNUAL REPORT OF THE ECONOMIC DIVISION 1924.

By D. H. Grist.

THE name of this Division was changed in December of this year, the Instruction Division becoming the Economic Division. With this re-organization Capt. Howlett leaves the Division and becomes Agricultural Instructor (Malay Officers) being placed in charge of the training of the Malay Officers of the Department, and the Field Division undertaking the duties of the organization of school garden work—duties that were performed by this Division for the greater part of the year and therefore included in this report.

The duties of the Economic Division are as follows:—

(*a*) The economics and marketing of agricultural products, especially produce of small holdings.

(*b*) Liaison with the Co-operative Societies Department. Encouragement of the co-operative movement among native agriculturists.

(*c*) Conferences of Malay Officers and Agricultural Shows, excluding organization of District Shows (Assistance to be given to the latter on request, but no part would be taken in administration of District Shows).

(*d*) Publication of the Malay Bulletin and educative pamphlets in Malay on questions concerned with agricultural economics and marketing.

Staff.

The Agricultural Instructor (Mr. D. H. Grist) was on leave from March 14th till December 5th, during which period Captain J. M. Howlett, Agricultural Instructor, was transferred from Kuala Kangsar to act in his absence. On the return of Mr. Grist, Captain Howlett left the Division to take up his new duties.

Raja Mohamed, Senior Agricultural Assistant, was transferred to Teluk Anson, Perak, at the beginning of April to carry out special duties in connection with a kapok buying scheme.

Sheikh Hamzah, Malay Translator to the Department was attached to the Division on 1.2.24, and has carried out translation and general clerical work during the year.

Kapok Buying Scheme.

The Division secured Government approval in February of a scheme for organising kapok purchase on the Perak river. Cash advances were to be given to Malay Kapok growers for uncleaned kapok;

the Division undertook the cleaning of the kapok and marketing of the floss, and profit to be distributed as a dividend. A collecting station was opened at Teluk Anson in charge of the Senior Agricultural Assistant. A sum of $1000 was allocated as working capital.

From the point of view of amount of kapok purchased (a little over twenty piculs) the scheme was not a success. Competition with Chinese buyers was largely responsible for the result, although the scheme had the salutary effect of making the Chinese raise their price from $5/- per picul to $12 per picul.

A hand kapok cleaning machine, on the design of the Bley machine used in Java was constructed, and proved suitable. It was found possible to clean kapok down to 2% of impurities with this machine.

PUBLICATIONS.

The Malay Bulletin of this Department (Warta Perusaha-an Tanah) was edited by the Division, and three parts of the second volume published during the year. The articles contained in these numbers were as follows:—

Vol. II	No. 1.	School Gardening.
	No. 2.	Maize School Gardening. Prevention of insect attack on fruit trees.
	No. 3.	Rat destruction Insect attack on coconut palms Money spent by Malays on daily purchase of vegetables. Mouldy rot disease of rubber.

The distribution of this publication is carried out by the Division. 3000 copies of each issue are circulated to all responsible Malays throughout the Peninsula, and to all schools, and the list revised from time to time.

Malays from all parts of the country, and especially from the Unfederated Malay States, have shewn their interest in this Bulletin. Several articles written by Malays have been submitted for publication, and one.—"Money spent by Malays on daily purchase of vegetables," a somewhat remarkable and thoughtful article, was published. In addition, a number of letters on agricultural matters have been received. Thirty six Malays made written application for a total of 311 copies of the various Malay pamphlets published by the Department.

"Pengasoh" a Malay newspaper published in Kelantan, contained a lengthy article on the work of the Department, and its Malay publications, and later in the year a further article advocating a Department of Agriculture in Kelantan.

Agricultural Shows and Exhibitions.

Public interest in agricultural shows and exhibitions in Malaya has been sustained—encouraged by the Malayan Agri-Horticultural Association, with which the Division has kept in close touch. The Association organised a very successful three days show and exhibition in Kuala Lumpur, and ten district agricultural shows were held under the auspices of the Association. The Acting Agricultural Instructor was Hon. Secretary of the Agricultural Section of the Association, and assisted in organising and judging at several of the District Shows.

The Division staged a Departmental exhibit of fibres, diseases of rubber, alcohol production, rubber oil and miscellaneous crops at the Kuala Lumpur Show. A modification of this exhibit was subsequently shewn at various District Shows.

Conference of Malay Officers of the Department of Agriculture.

The Annual Conference of the Malay Officers of the Department was held on November 18th to 20th at Kuala Lumpur. The Hon'ble the Chief Secretary (Sir George Maxwell, K.B.E., C.M.G.) delivered an opening address. Papers were read in English as under, each being followed by a short discussion.

"The duties of Malay Agricultural Officers" by Mr. F. W. South.

"Insects and Human Welfare" by Mr. B. A. R. Gater.

"The Principles of Stock and Poultry Breeding" by Mr. J. M. Howlett.

"The Formation of Local Phosphates and their application" by Mr. V. R. Greenstreet.

The following papers were read in the Malay language:—

"Miseltoes in relation to cultivated trees" by Inche Mohamed Zain.

"The practical distribution of improved strains of padi" by Inche Din.

"Methods of study of insect pests" by Inche Mohamed Yusope.

A visit was made to the Serdang Experimental Plantation.

Lectures.

The Acting Agriculture Instructor delivered lectures as under:—

Teluk Anson March 29th on "The objects of the Malayan "Agri-Horticultural Association."

Sitiawan June 15th on "Fibres."

School Gardens.

School garden work has become more popular amongst teachers throughout the country. They have been assisted by the periodical inspections made by officers of this Division, by articles on the subject published in the Malay Bulletin, and the supply of planting material.

Sites and schools gardens in Penang and Province Wellesley were visited by the Acting Agricultural Instructor, and advice given on such questions as rotations. A similar visit was made to Malacca, where thirty schools were visited, and a report made in connection with two sites. The condition and general garden work in Malacca schools were most encouraging.

The schools in Perak competed for gardening prizes offered by the Hon'ble British Resident, Perak, which has undoubtedly stimulated school garden work in the State.

Malay Officers Training.

Two courses of lectures by various of the scientific officers of the Department were held during the year. A course of lectures, Part I was commenced in February ; twelve Malay officers took the course of whom eleven passed the terminal examination. A course of lectures, Part II, commenced on September 29th., thirteen Malay Officers taking the course. The course had not terminated by the end of the year.

An examination of Junior Agricultural Assistants to qualify for promotion to Senior Agricultural Assistants was held in July, seven officers sat, of which number, four passed.

An examination of Probationers to qualify for promotion to the grade of Junior Agricultural Assistants was held in July. Of five officers sitting for this examination, four passed.

The writer proposed a scheme for commencing a School of Agriculture near the Experimental Plantation, Serdang. The scheme was not approved on account of cost.

The work of training officers throughout the year has been in the hands of the Division, assisted by lecture courses by six scientific officers of the Department. In the time at the disposal of these officers, and also of the Malay Officers taking the courses, the standard of proficiency attained by the Malay Officers was not high. This was reflected in the examination work of the students. In consequence of the unsatisfactory nature of these and former results, and also to the fact that the proposed School of Agriculture did not receive Government sanction, the Acting Agricultural Instructor and the Chief Agricultural Inspector drew up a scheme of Malay Officers training, under the Agricultural Instructor. This allows for the full time of each new Malay Officer being devoted to study for a period of two years of three terms in each year. The lectures, with practical work will be given at the Department of Agriculture, Kuala Lumpur,

by the Agricultural Instructor and Raja Mahmud (Assistant Agricultural Instructor). This scheme was approved and commenced operation from December 15th.

Miscellaneous.

As indicating the large number of enquires received by the Division on the cultivation and marketing of various crops, the following subjects were dealt with in correspondence during the period under review:—Indigo, kapok, tobacco, rubber seed oil, sago palm, coir preparation, bee-keeping, seeweed, and roselle.

In conjunction with the Forest Department, an article on Malayan damar as a "cottage industry" was prepared for publication in the Malay Bulletin.

Towards the end of the year, an investigation of the marketing possibilities of tuba (Derris elliptica) was put in hand.

ANNUAL REPORT OF THE PLANT PHYSIOLOGIST FOR 1924.

By W. N. C. Belgrave.

The Staff of the Division remained unchanged and consisted of :—

Mr. W. N. C. Belgrave.

Inche Haji Abdul Wahid.

Inche Jalaludin.

Work was almost entirely on Hevea latex, and was mainly directed to :—

(*a*) Chemical and physical phenomena connected with coagulation.

(*b*) The proteins and allied substances.

None of this work has reached finality, and a detailed account must be deferred until publication can be undertaken. It suffices to state here that considerable time has been devoted to De Vries' recent theory that coagulation following on separation is, or may be, brought about by an enzyme in latex. The writer has been unable to satisfy himself that the theory can be regarded as proved.

Tapping experiments involving the girdling of the trees under observation have continued and have not resulted in any apparent damage.

Additional Duties.

The writer acted throughout the year as Assistant to Secretary for Agriculture, and was in charge of the Library and of the publications of the Department.

It is hoped shortly to issue a much needed catalogue of the Library ; in this compilation the services of Mr. L. A. J. Rijk have been of great value.

Publications of the Department of Agriculture.

The following publications, except those out of print, may be obtained on application to the Office of the Secretary for Agriculture; and the Malay States Information Agency, 88, Cannon Street, E C. London.

A remittance to cover the cost should accompany applications; otherwise the Journals will be sent by post, Cash on Delivery, where that system is in force.

1. The Agricultural Bulletin F.M.S.

Vols. I—IV (1913-16) VIII & IX (1920-21)		price $5.00 per volume.	
Vol. V	(1917) Nos. 1, 2, 3, 5 & 6	„	2.50 per set.
„ VI	(1918) „ 1, 7, 8 & 12	„	2.00 „
„ VII	(1919) „ 2—6	„	4.50 „

2. The Malayan Agricultural Journal (continuing the Agricultural Bulletin). Published monthly.

Vol. X (1922)		Price $5.00 per volume.	
„ XI (1923)	Price $5.00 per volume or 50 cents per single number.		
„ XII (1924)	„	„	„

Back numbers of Vols. I—X will not be sold singly.

3. The Handbook of Malayan Agriculture, price $1.00.

Current numbers of the Malayan Agricultural Journal and the Handbook may be purchased at the Railway Bookstalls and Branches of Messrs. The Federal Rubber Stamp Co.

4. *Special Bulletins.*

1. Notes on *Termes Gestroi* and other species of Termites found on Rubber Estates in the Federated Malay States, by H. C. Pratt, Government Entomologist, 1909, 20 cts.
2. Root Diseases of *Hevea Brasiliensis*, by W. J. Gallagher. C
3. Observations on *Termes Gestroi* as affecting the Para Rubber Tree and methods to be employed against its Ravages, by H. C. Pratt, Government Entomologist, 1910, reprint 1916, 20 cts. (Out of Print.)
4. A Lepidopterous Pest of Coconuts, *Brachartona catoxantha, Hamps*, by H. C. Pratt, 1909. C
5. The Extermination of Rats in Rice Fields, by W. J. Gallagher, 1909. C
6. Preliminary note on a Branch and Stem Disease of *Hevea Brasilienisis*, by W. J. Gallagher, 1909. C
7. Coffea Robusta, by W. J. Gallagher, Government Mycologist, 1910, 20 cts.
8. The Cultivation and Care of the Para Rubber Tree (in Malay) 1910. C
9. Die-Back Fungus of Para Rubber and of Cacao, by K. Bancroft, 1911. C
10. A Lecture on the Para Rubber Tree, by W. J. Gallagher, 1910. C
11. Coconut Cultivation, by L. C. Brown, 1911. C
12. Padi Cultivation in Krian, by H. C. Pratt, 1911. C
13. A Root Disease of Para Rubber, *Fomes Semitostus*, by K. Bancroft, Assistant Mycologist 1912, 20 cts.

C = Cancelled